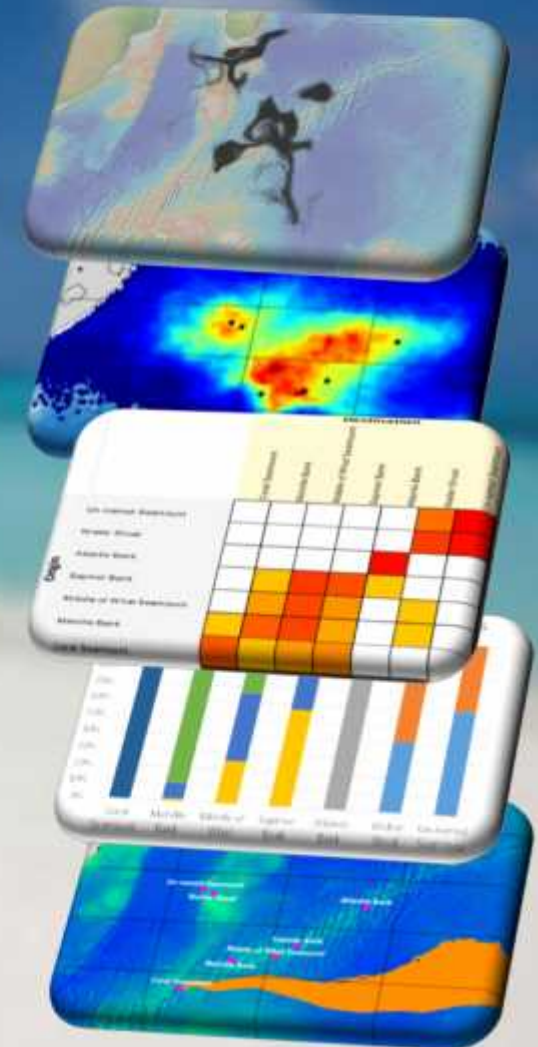
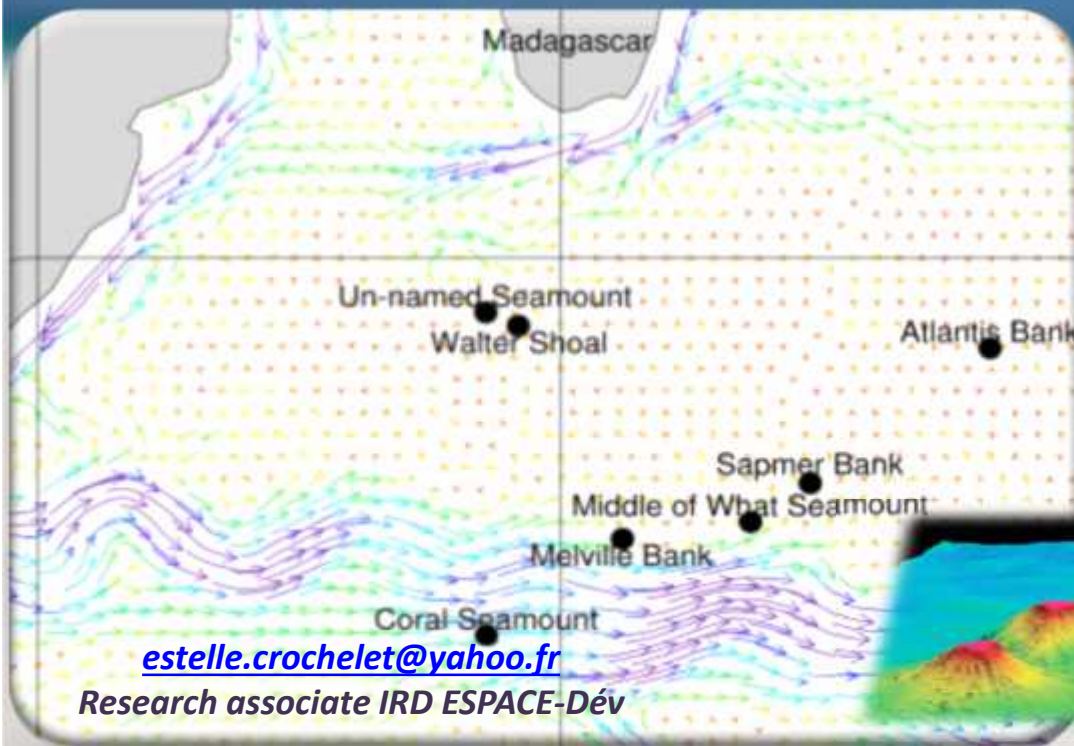




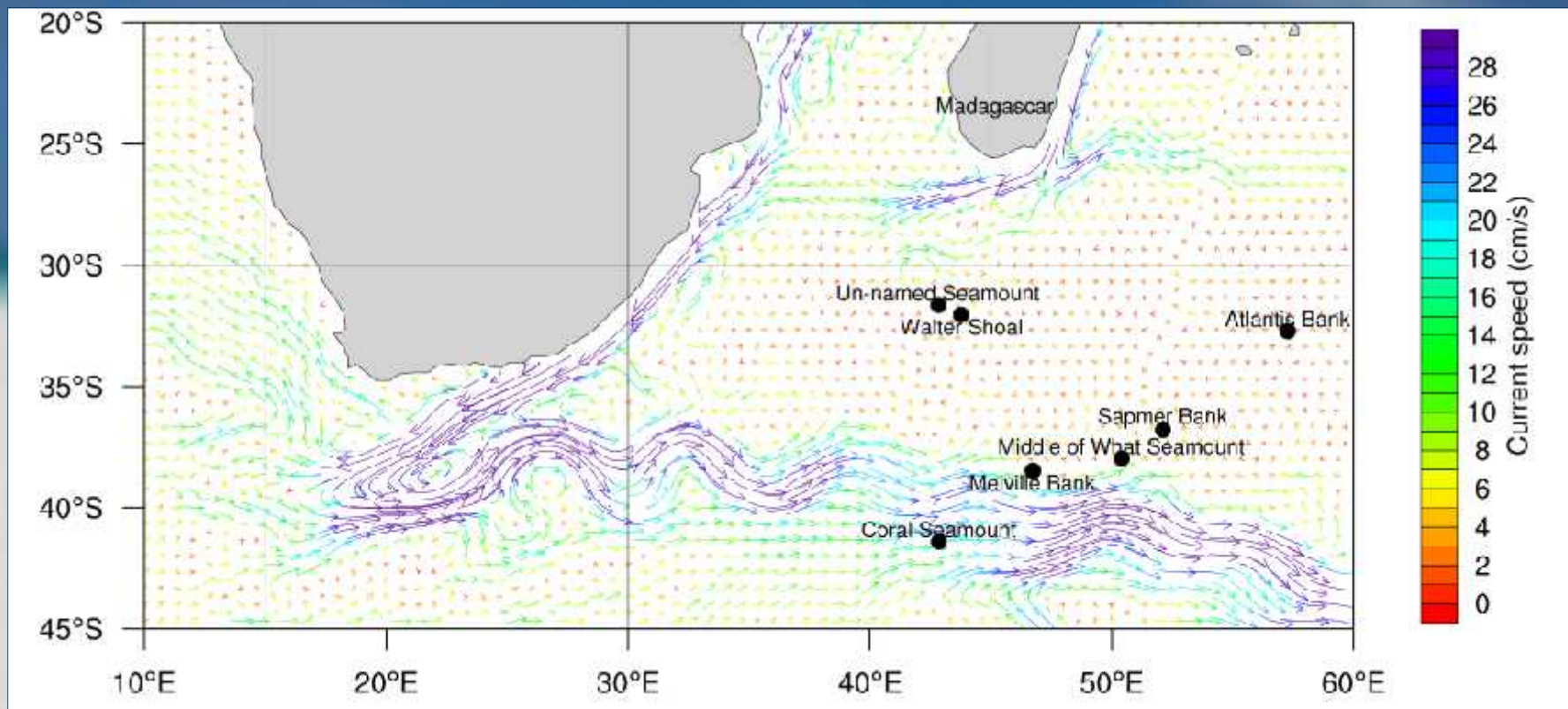
FONDS FRANÇAIS POUR  
L'ENVIRONNEMENT MONDIAL

# MARINE LARVAL CONNECTIVITY BETWEEN SWIO SEAMOUNTS

15 November 2017, Seychelles  
Estelle CROCHELET

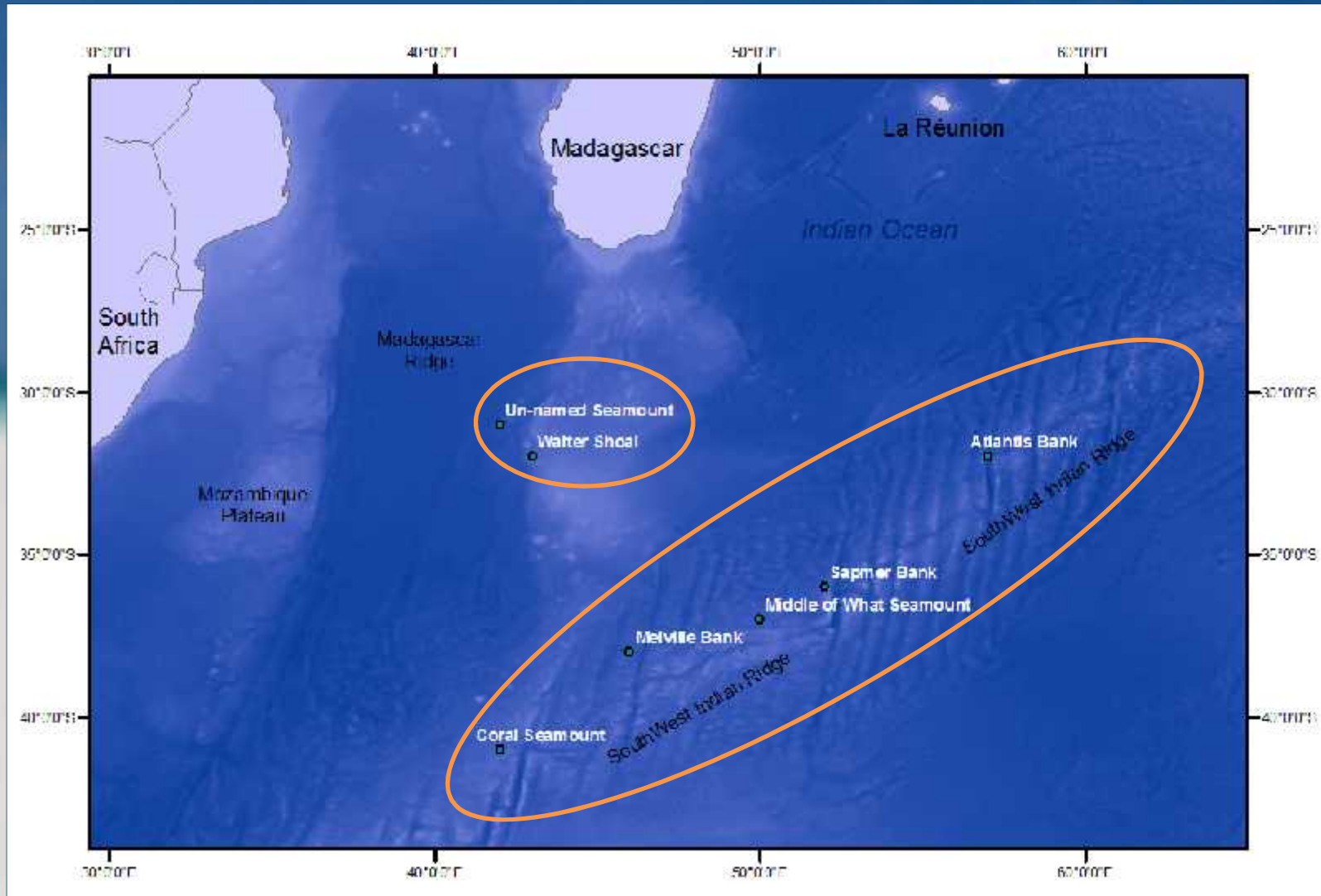


# Southwestern Indian Ocean hydrodynamics



OSCAR data (2010-2016)

# Seamounts location



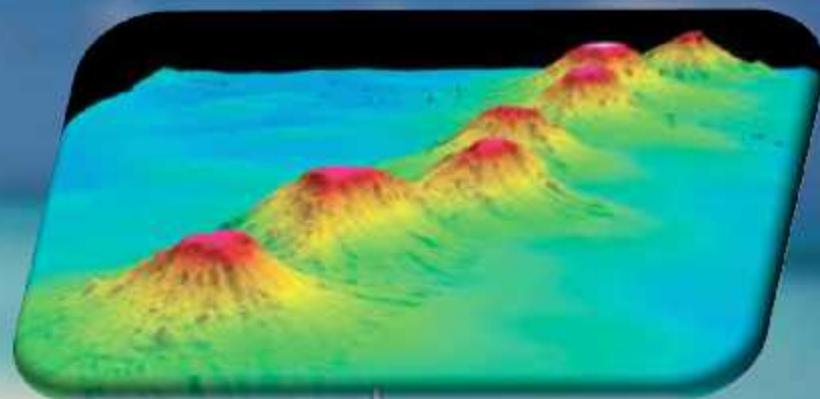
## Seamounts attributes

Name	Latitude	Longitude	Summit depth (meters)	Morphology
Atlantis Bank	32°42.69'S	57°16.69'E	690	Elongate / irregular
Sapmer Bank	36°48.00'S	52°07.32'E	261	Irregular
Middle of What Seamount	37°57.64'S	50°24.67'E	876	Irregular / elliptical (split)
Coral Seamount	41° 24.21'S	42° 51.33'E	175	Irregular / rectangular
Melville Bank	38°28.41'S	46°45.05'E	91	Elongate / irregular (two peaks)
Un-named Seamount	31°37.86'S	42°49.85'E	1249	Dome-shaped
Walter Shoal	32°2.27'S	43°46.9'E	15	N/A

# MARINE SPECIES

- Species with long dispersive phase (larvae stage) => genetic connectivity between seamounts

- Non dispersive phase => endemic to a seamount or a group of seamounts



→ Focus on dispersive species only



# OSCAR PRODUCTS

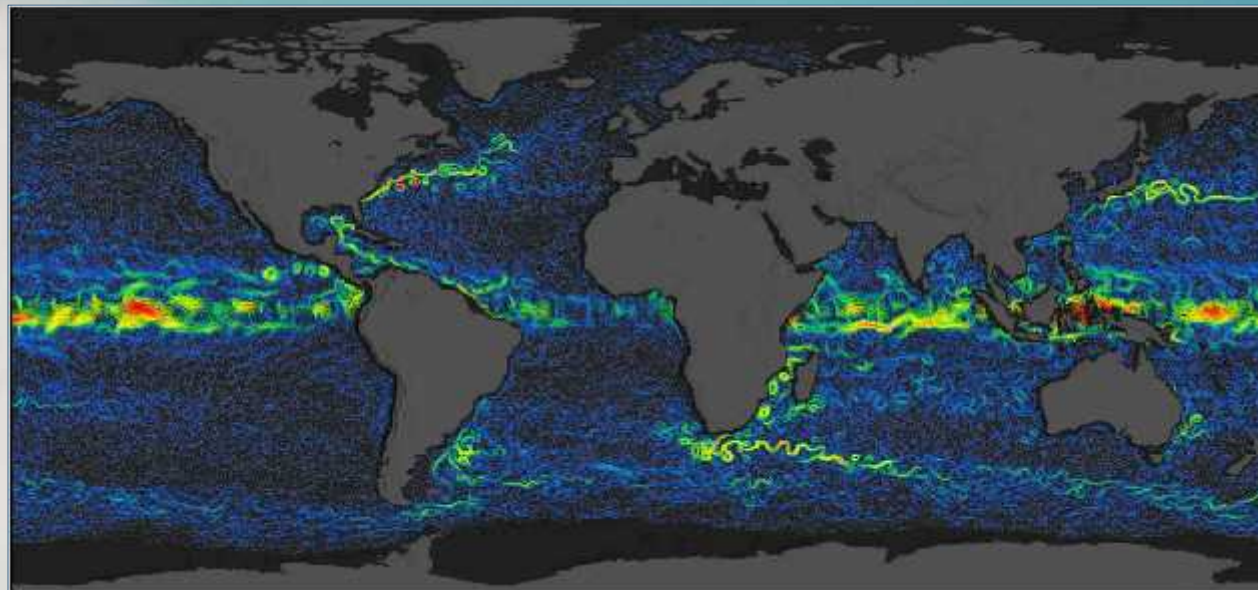
Derived from satellite altimetry data

3D (longitude, latitude, time)

$1/3^\circ$  resolution

Available from 21 octobres 1992 to day

Depth = 15 meters





# ICHTHYOP HYDRODYNAMIC DISPERSAL MODEL

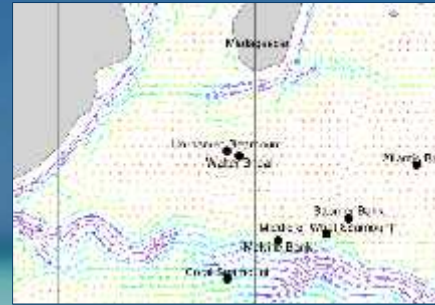
Habitat map: seamounts  
location

1



2

Ocean currents data  
(2010-2016)



3

Biological parameters

Release date: New moon, every month, from 2010 to 2016

PLD: 15, 30, 45, 60, 90, 120, 180, 270, 360 days

Density: 10 000 larvae

Behavior: passive particles

Larval dispersal  
animation



Connectivity matrix

Source	Target	Connectivity
Midway Bank	Midway Bank	1.0
Midway Bank	Lisianski Bank	0.2
Midway Bank	Pearl and Hermes Bank	0.1
Midway Bank	Nihoa Bank	0.0
Midway Bank	Gardner Pinnacles	0.0
Lisianski Bank	Midway Bank	0.1
Lisianski Bank	Lisianski Bank	1.0
Lisianski Bank	Pearl and Hermes Bank	0.3
Lisianski Bank	Nihoa Bank	0.1
Lisianski Bank	Gardner Pinnacles	0.0
Pearl and Hermes Bank	Midway Bank	0.0
Pearl and Hermes Bank	Lisianski Bank	0.2
Pearl and Hermes Bank	Pearl and Hermes Bank	1.0
Pearl and Hermes Bank	Nihoa Bank	0.1
Pearl and Hermes Bank	Gardner Pinnacles	0.0
Nihoa Bank	Midway Bank	0.0
Nihoa Bank	Lisianski Bank	0.1
Nihoa Bank	Pearl and Hermes Bank	0.2
Nihoa Bank	Nihoa Bank	1.0
Nihoa Bank	Gardner Pinnacles	0.0
Gardner Pinnacles	Midway Bank	0.0
Gardner Pinnacles	Lisianski Bank	0.0
Gardner Pinnacles	Pearl and Hermes Bank	0.0
Gardner Pinnacles	Nihoa Bank	0.0
Gardner Pinnacles	Gardner Pinnacles	1.0

# ANALYSIS METHODS

## Several metrics:

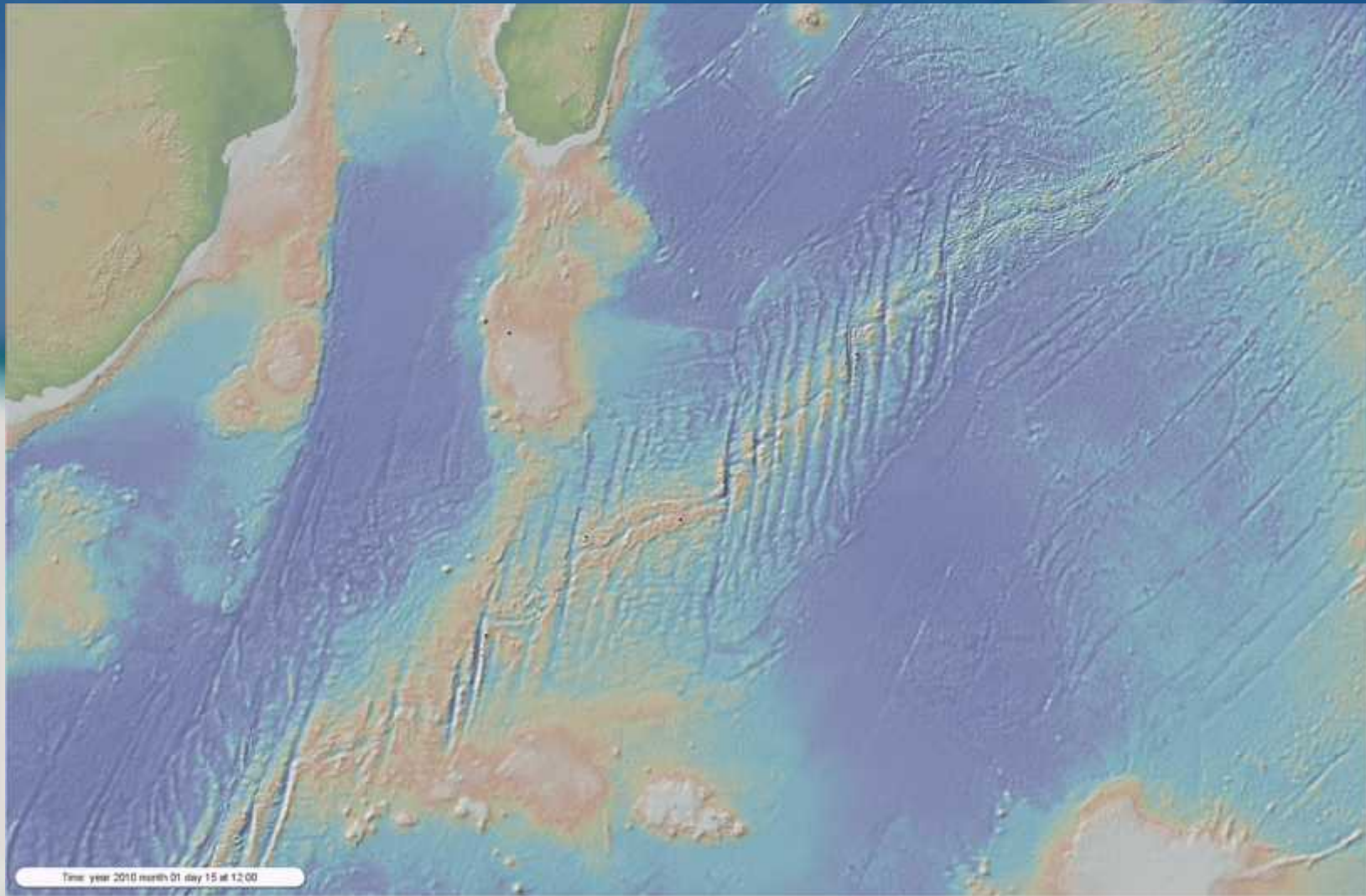
- Distance between sites
  - Dispersal distances depending on Pelagic Larval Duration
  - Connectance
  - Local retention
  - Larval export
  - Self-recruitment
  - Larval density over the study area
  - Trajectories depending on seamounts
- Between seamounts
- From seamounts to coastal ecosystems: South Africa, Madagascar, Mozambique



# RESULTS



## Larval dispersal animation



# RESULTS

## Dispersal distances depending on Pelagic Larval Duration

PLD (d)	15	30	45	60	90	120	180	270	360
Mean distance - km (without coastal ES)	325,8	539,5	592,3	681,1	846,3	1034,0	963,8	963,8	963,8
Mean distance - km (withcoastal ES)	325,8	550,6	630,8	733,0	870,2	1026,9	1007,9	1149,4	1195,4

## Connectance

### Between seamounts

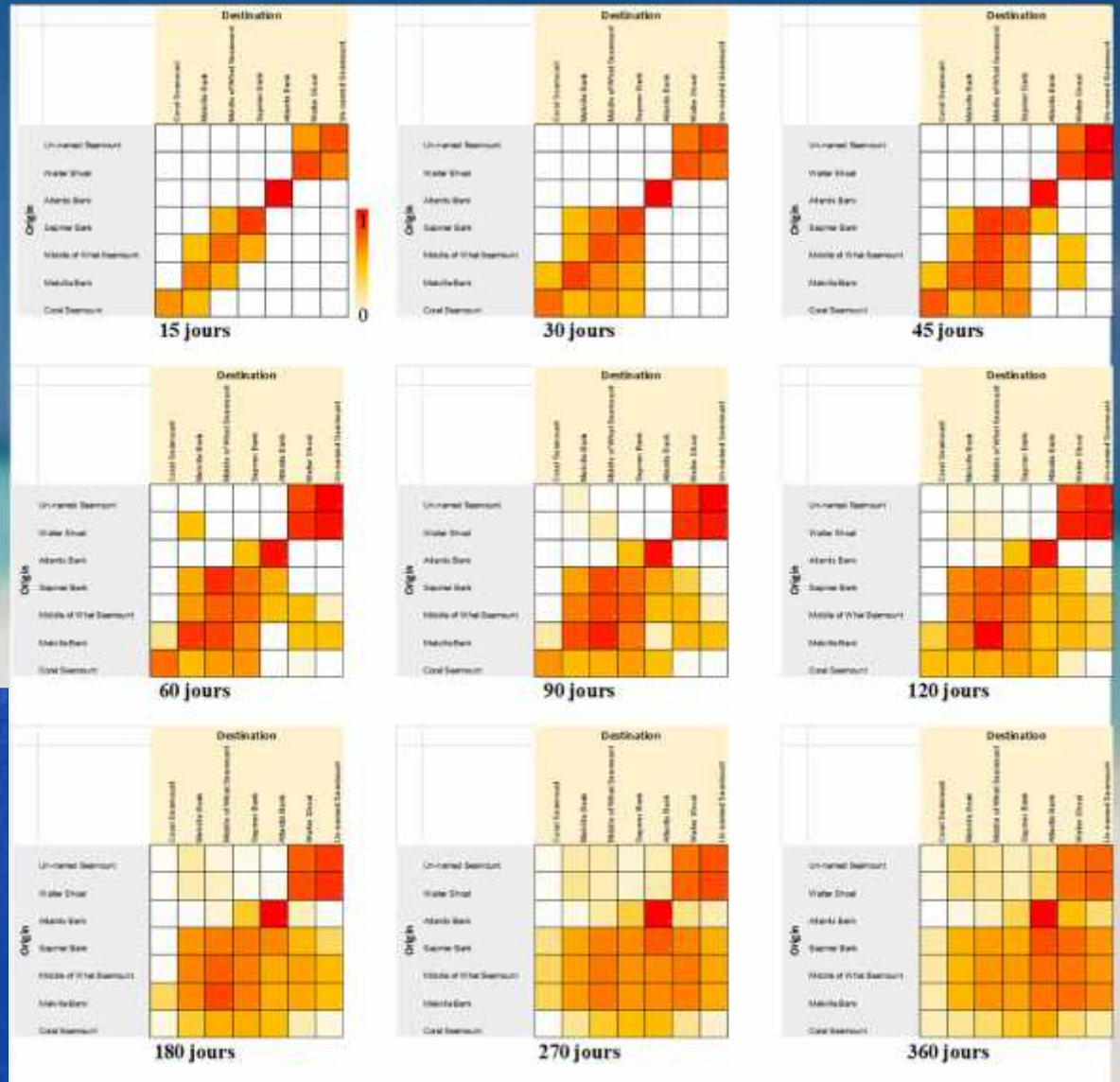
PLD (d)	15	30	45	60	90	120	180	270	360
Connectance (%)	28,6	34,7	44,9	57,1	79,6	87,8	98,0	98,0	98,0

### Between seamounts and coastal ES

PLD (d)	15	30	45	60	90	120	180	270	360
Connectance (%)	0	3,6	10,7	17,9	21,4	21,4	32,1	64,3	75,0

# RESULTS

Connectivity matrices  
 For each PLD (15 to  
 360 days)  
 BETWEEN  
 SEAMOUNTS

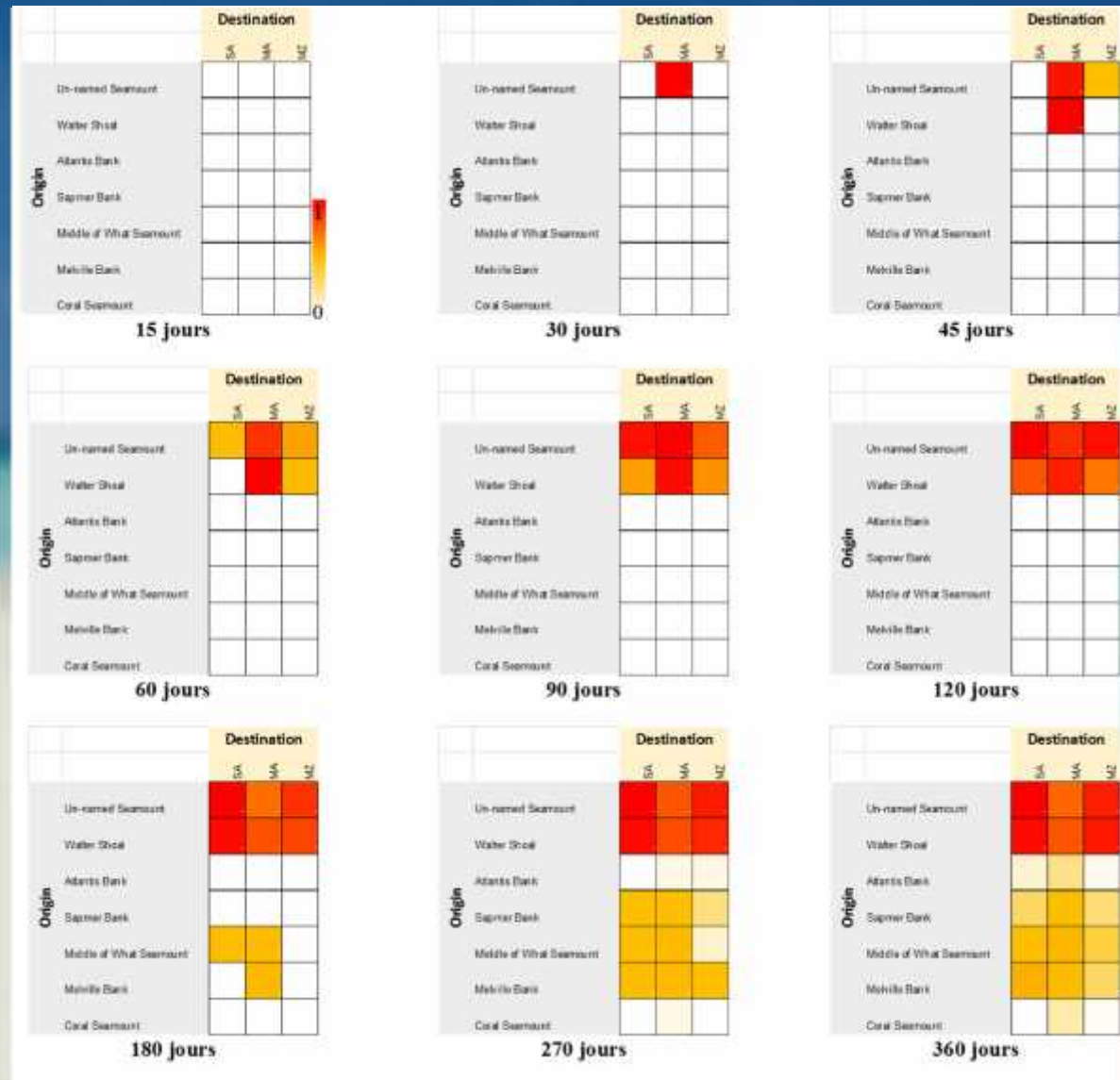


# RESULTS

Connectivity matrices

For each PLD (15 to 360 days)

FROM SEAMOUNTS TO  
COASTAL ECOSYSTEMS

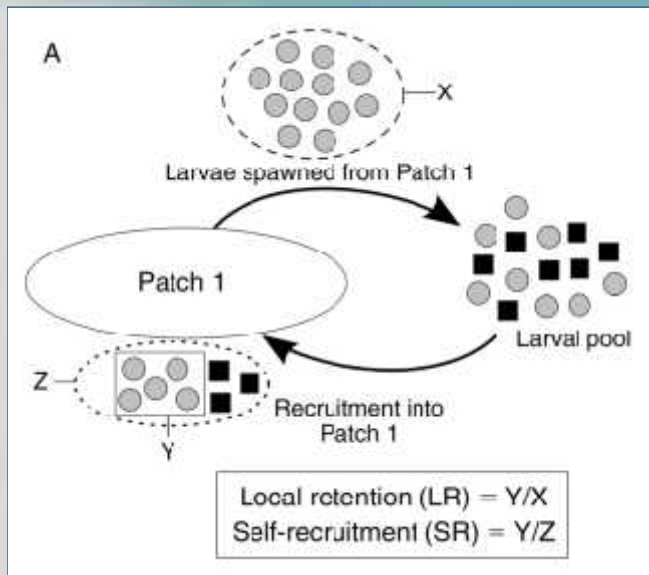


# RESULTS

## Larval export

DVL	15	30	45	60	90	120	180	270	360
Export larvaire (%)	0,9%	0,9%	0,8%	0,7%	0,5%	0,5%	0,4%	0,3%	0,3%

Larval export very weak (btw 0,3 and 0,9%)



## Local retention

PLD (d)	15	30	45	60	90	120	180	270	360
Larval retention (%)	4,2%	1,9%	1,0%	0,7%	0,5%	0,3%	0,2%	0,1%	0,1%

Larval retention for all seamounts and all PLD

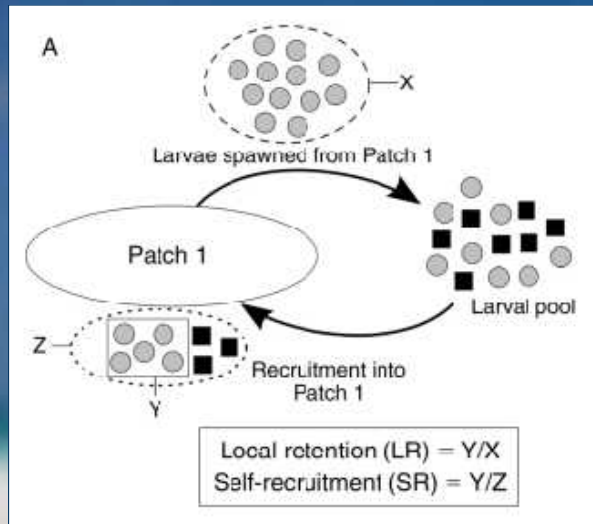
Decrease with increase of PLD

Larval retention very weak (btw 0 and 4%)

Most retentive seamount : Atlantis Bank

# RESULTS

## Self recruitment



DVL	15	30	45	60	90	120	180	270	360
Auto-recrutement (%)	84,6%	71,7%	64,4%	60,0%	54,8%	44,9%	33,1%	24,7%	22,6%
Allo-recrutement (%)	15,4%	28,3%	35,6%	40,0%	45,2%	55,1%	66,9%	75,3%	77,4%

Self-recruitment for all seamounts and all PLD

Decrease with increase of PLD

Larval retention value between 22 and 85%

Most retentive seamount : Atlantis Bank

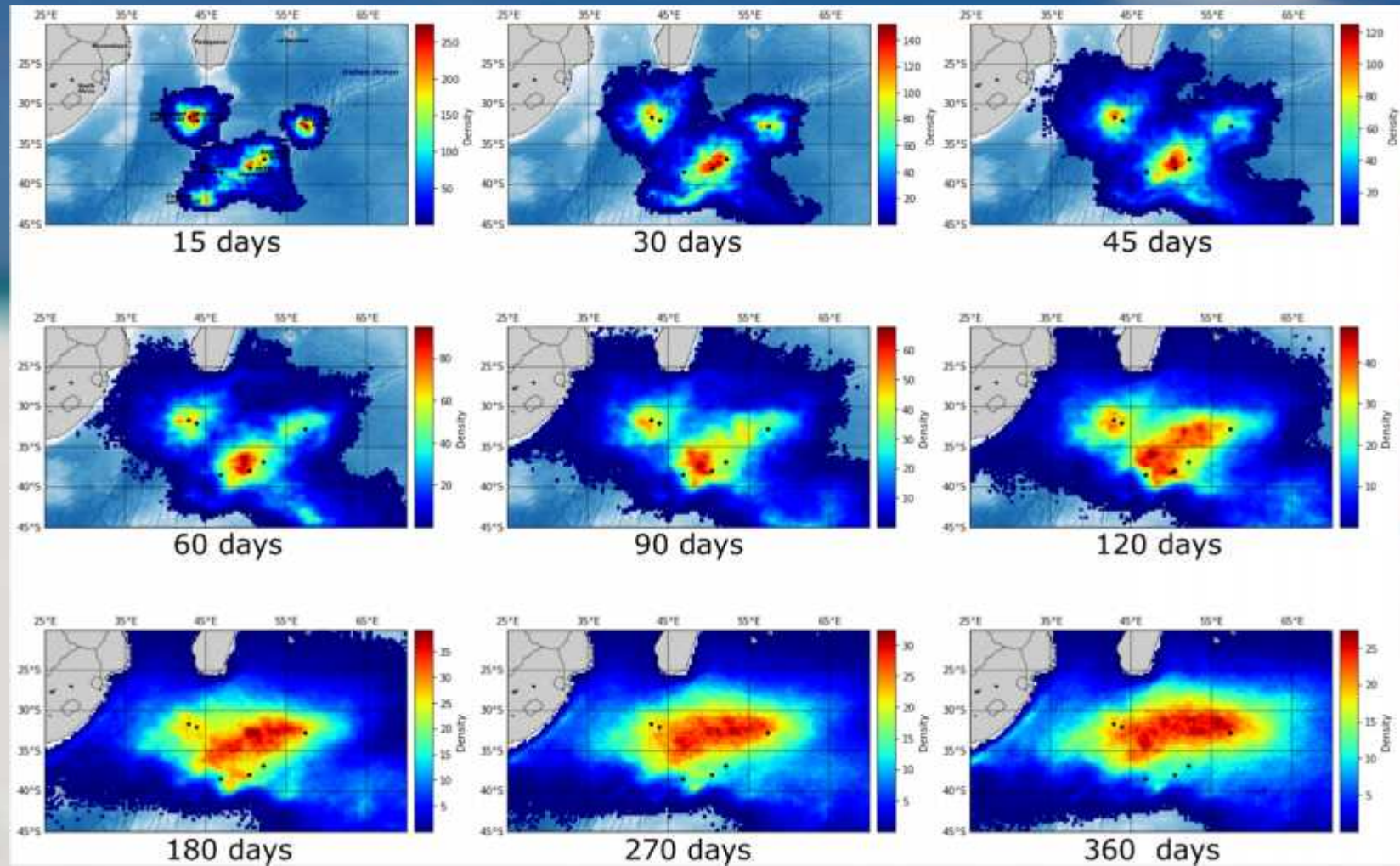


100% self-recruitment on Atlantis Bank and Coral Seamount until 60 days of PLD

Walters' Shoal and Un-named Seamount highly connected from 15 days PLD and maintain bi-directional exchanges only until 60 days PLD

# RESULTS

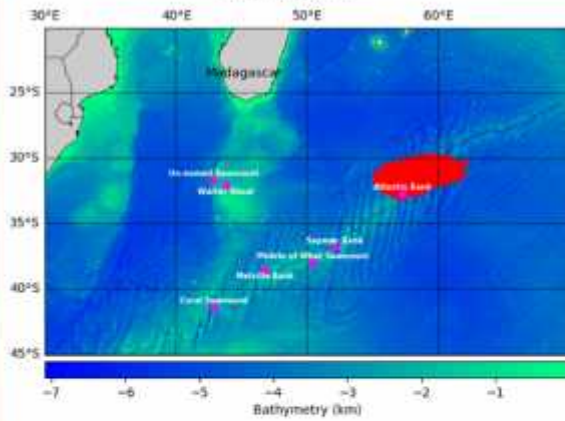
## Larval density over the study area



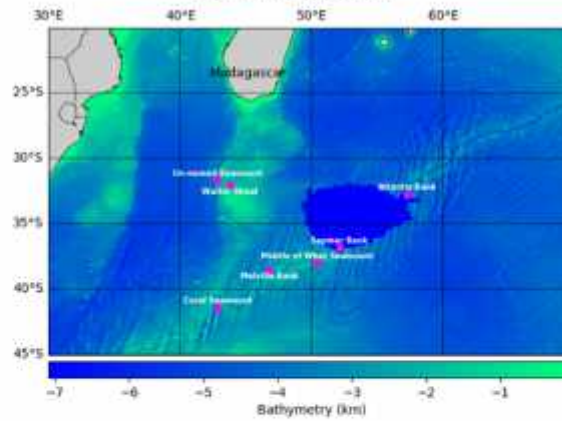


Trajectories depending on seamounts

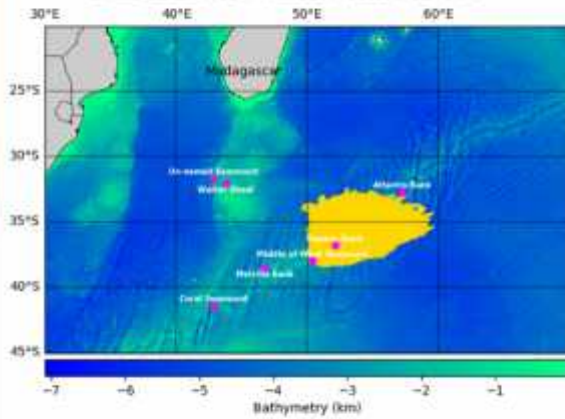
ATLANTIS



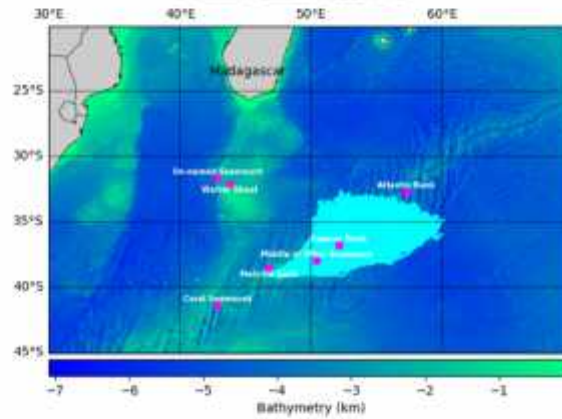
SAPMER BANK



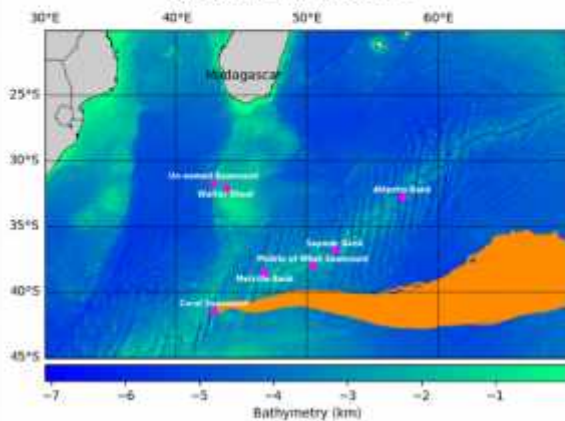
MIDDLE OF WHAT SEAMOUNT



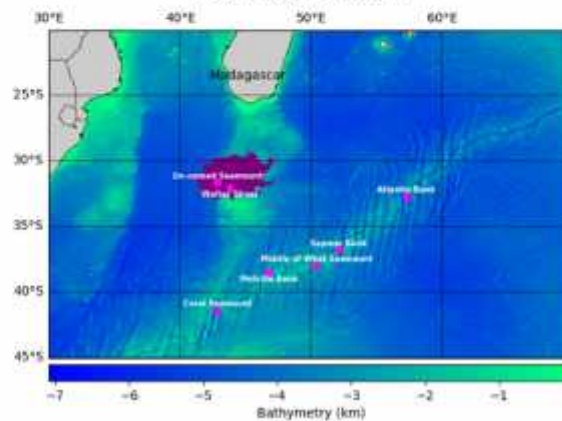
MELVILLE BANK



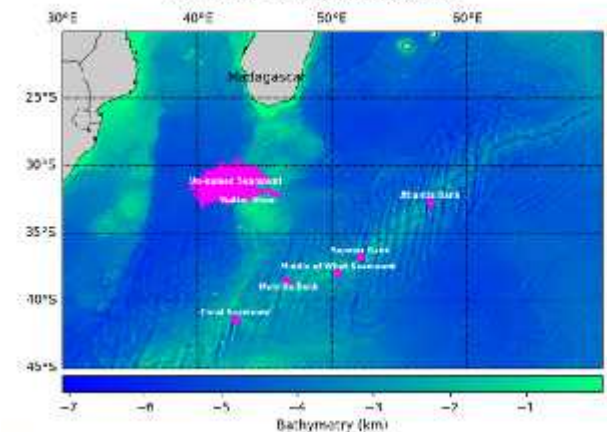
CORAL SEAMOUNT



WALTER SHOAL



UN-NAMED SEAMOUNT





Thank you for your attention!