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Findings from 111 satellite tags deployed on Indian Ocean billfish during the FLOPPED project

Anne-Elise Nieblas, Serge Bernard, Blandine Brisset, Maxime Bury, Jérémie Chanut, Thomas Chevrier, Rui Coelho, Yann Colas, Hugues Evano, Cyril Faure, et al.

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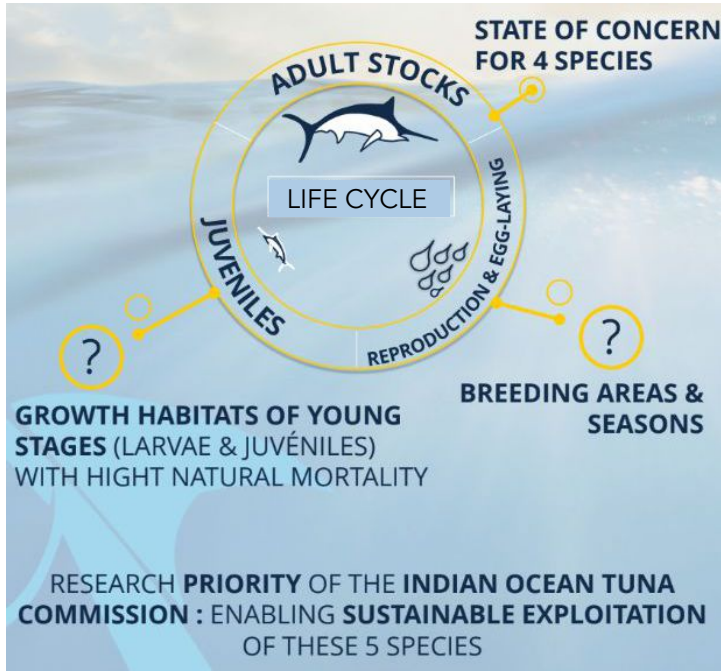
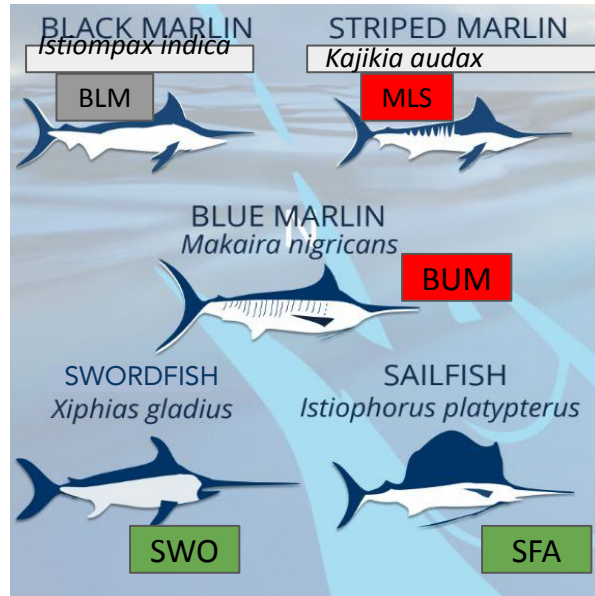


Findings from 111 satellite tags deployed on Indian Ocean billfish during the FLOPPED project (2019-2023)

Anne-Elise NIEBLAS¹, Serge BERNARD², Blandine BRISSET³, Maxime BURY⁴, Jérémie CHANUT¹, Thomas CHEVRIER¹, Rui COELHO⁵, Yann COLAS⁶, Hugues EVANO³, Cyril FAURE⁷, Gaëtan HERVÉ⁸, Vincent KEZERHO², Amelie NITHARD³, Ross NEWTON⁹, Tracey NEWTON⁹, Tristan ROUYER³, Sean TRACEY¹¹, J. Worthington¹², Sylvain BONHOMMEAU³

FINDING LARGE OCEANIC PELAGIC PREDATORS' ENVIRONMENTAL DISTRIBUTION

5 BILLFISH SPECIES in the Indian Ocean



MULTIDISCIPLINARY APPROACH TO INVESTIGATE THE BREEDING AREAS OF INDIAN OCEAN BILLFISH



IDENTIFY THE BREEDING AREAS AND PERIODS OF BILLFISH



DETERMINE THE SIZE OF BREEDING POPULATIONS WITHIN BREEDING AND SPAWNING AREAS

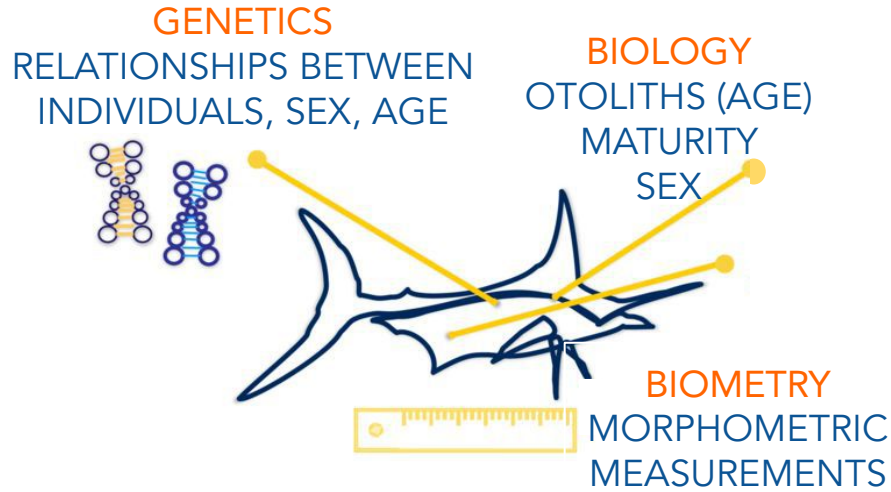


DETERMINE KINSHIP RELATIONSHIPS BETWEEN INDIVIDUALS TO ASSESS LEVELS OF CONNECTIVITY BETWEEN DIFFERENT BREEDING AREAS

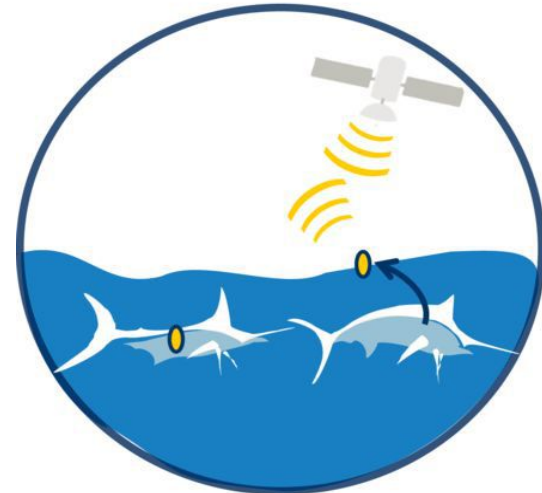


DETERMINE BILLFISH LARVAE ORIGIN

METHODS TO BETTER UNDERSTAND THE 5 BILLFISH SPECIES

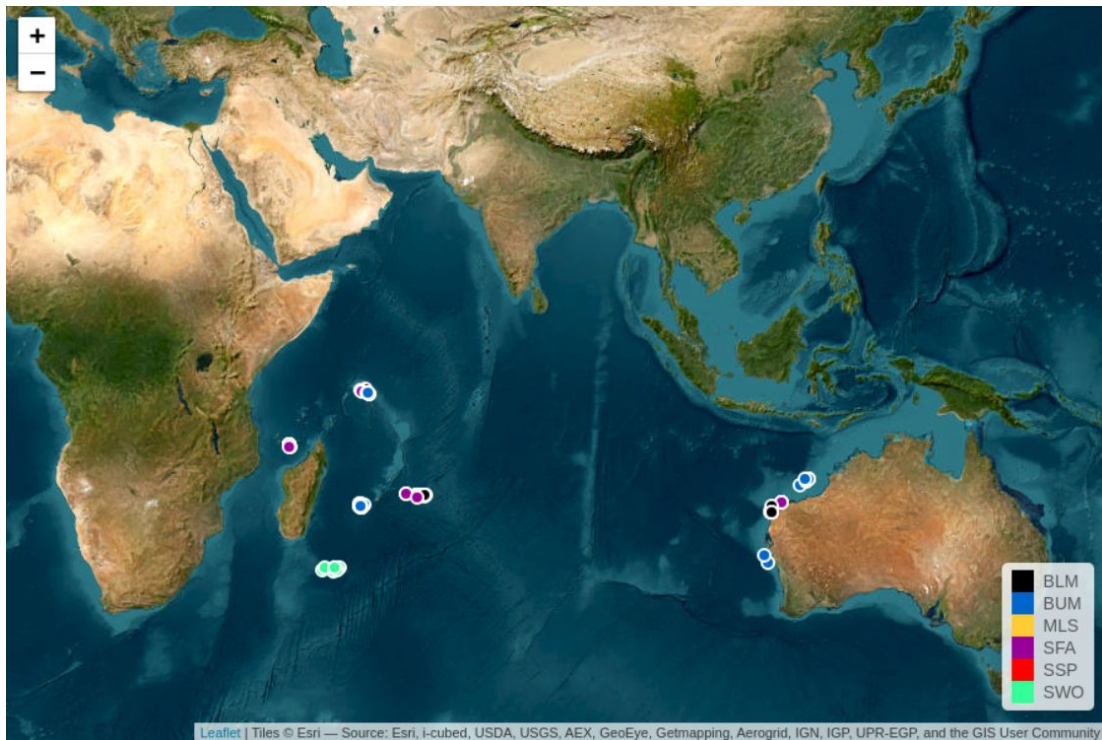


SATELLITE TAGGING



100 SATELLITE TAGS (20 PER SPECIES)
IDENTIFICATION OF MOVEMENT DURING
BREEDING PERIODS

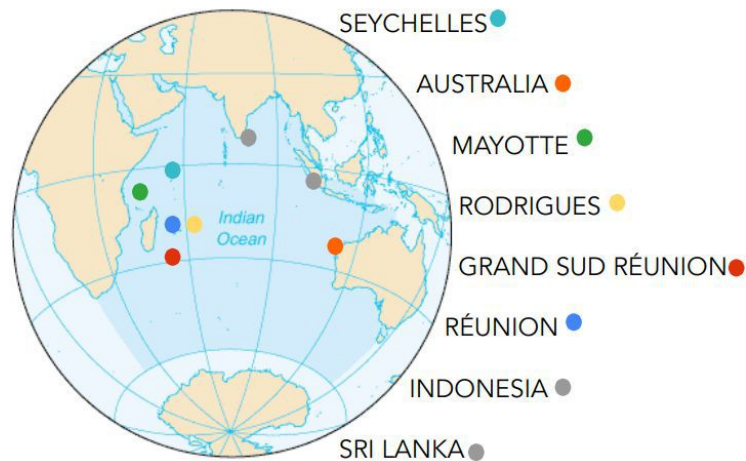
111 TAGS AROUND THE INDIAN OCEAN



SITES OF TAG DEPLOYMENTS BY SPECIES

TAG DEPLOYMENTS BY:

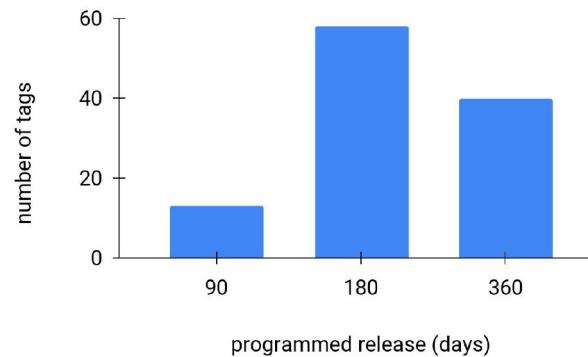
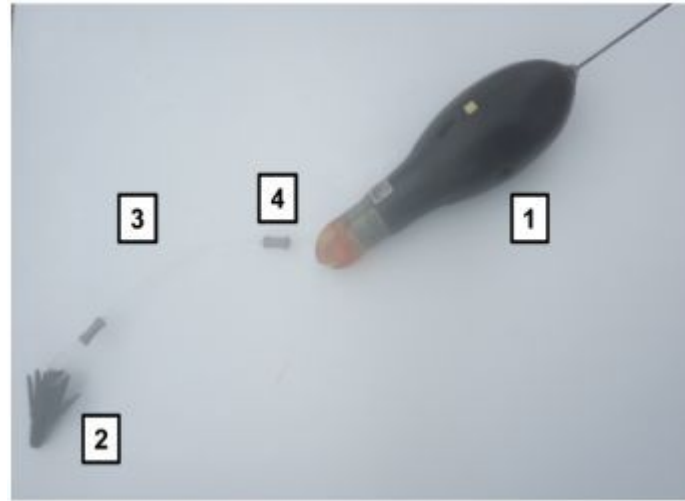
- COOOL, IFREMER TEAMS
- OBSERVERS and SCIENTISTS
- RECREATIONAL FISHERS



111 TAGS AROUND THE INDIAN OCEAN

- 1) WILDLIFE COMPUTERS PSAT TAG
- 2) ANCHOR : LARGE DOMEIER
- 3) FLUOROCARBON LINE 120/100
- 4) STAINLESS STEEL SLEEVE

Line length	Size of fish
8 cm	50-60 kg
10 cm	>60kg <140 kg
13 cm	>140 kg



TAGS PROGRAMMED BETWEEN 90-365 DAYS

111 TAGS AROUND THE INDIAN OCEAN



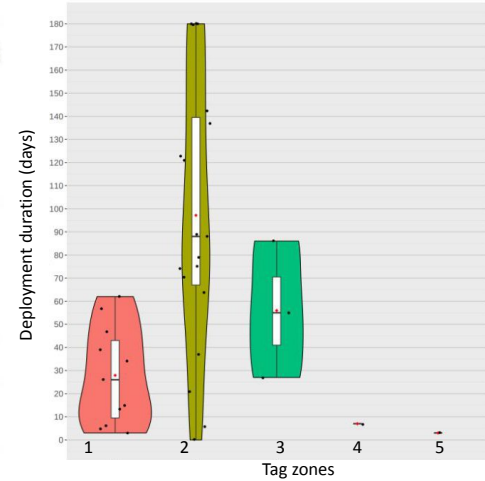
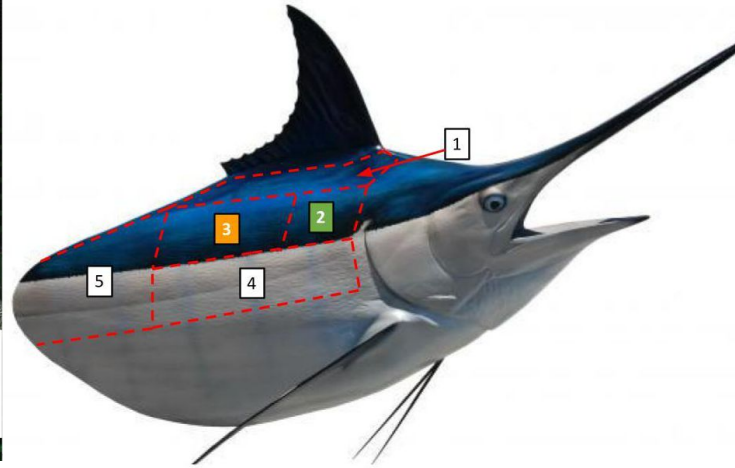
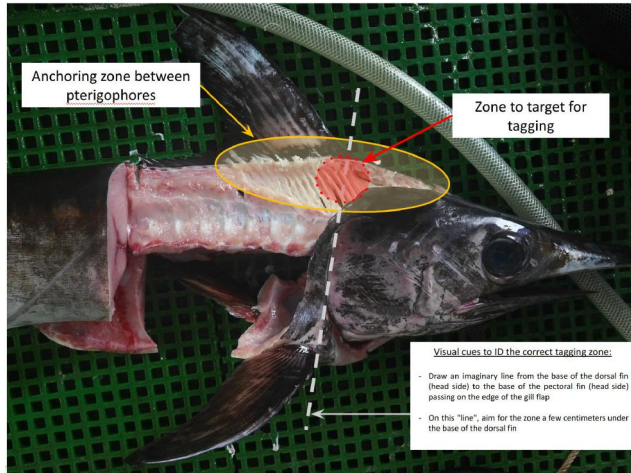
TAGGING EVENT

PROTOCOL COMMUNICATED

1. VIDEO THE TAGGING EVENT
2. ROD-AND-REEL (BUM,BLM,MLS,SFA), LONGLINE (SWO)
3. FISH BROUGHT ALONGSIDE
4. ASSESS FISH FITNESS
5. CONTROL AND PRESENT BROAD TARGET TO TAG
6. CAREFULLY PLACE TAG AND PUSH FIRMLY IN THE *OPTIMAL TAG ZONE*
7. ESTIMATE LENGTH
8. REMOVE HOOK/CUT LINE
9. REVIVE FISH
10. FILL OUT TAGGING FORM

111 TAGS AROUND THE INDIAN OCEAN

STEP 5 - TARGET THE OPTIMAL TAGGING ZONE (2)

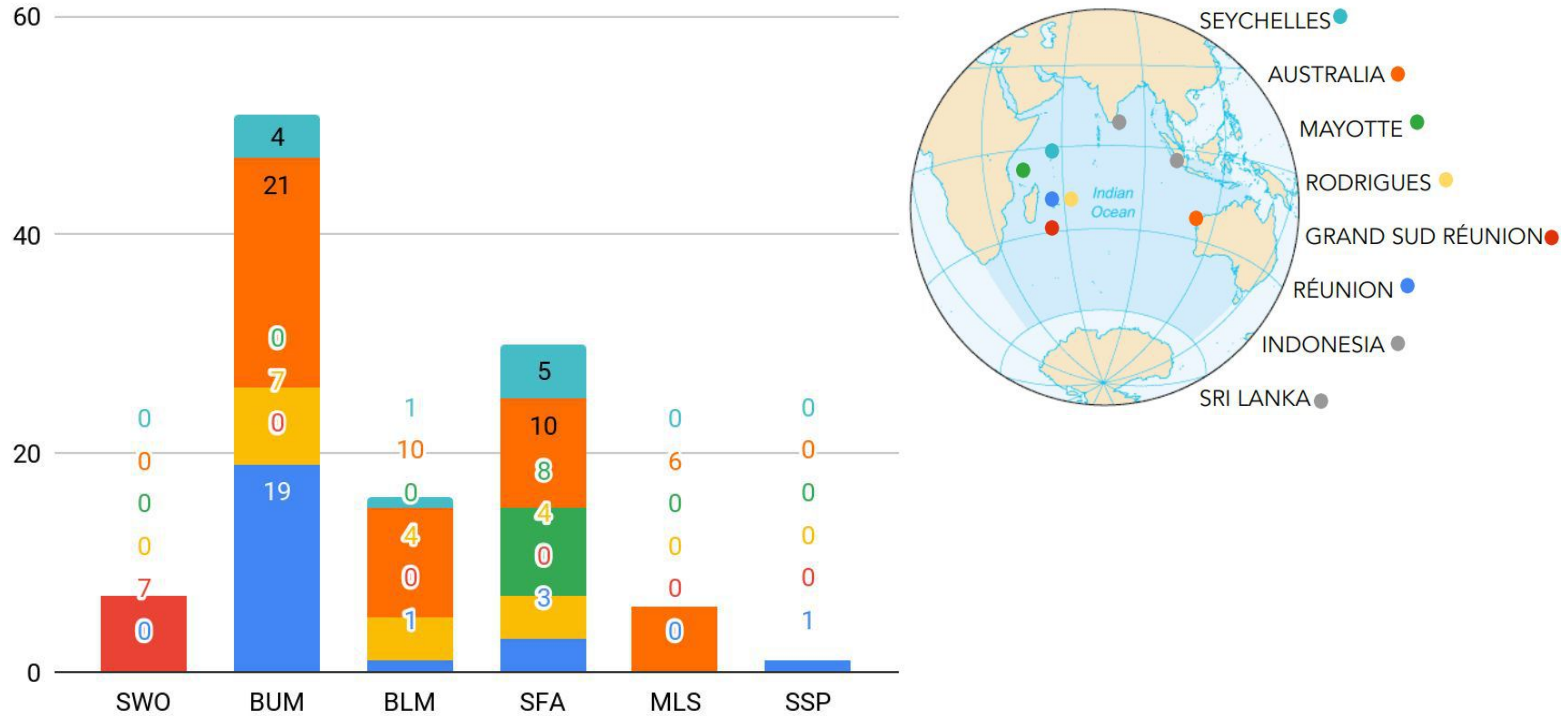


TARGET THE PTERYGIOPHORES
(SWO PICTURED)

OPTIMAL TAGGING ZONES (2 AND 3)
(BUM PICTURED)

DEPLOYMENT DURATION
BY TAGGING ZONE

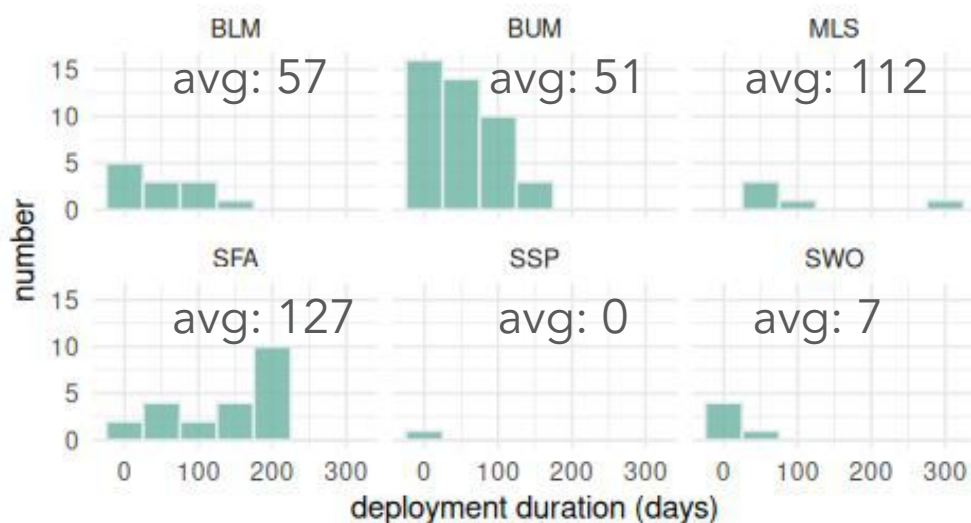
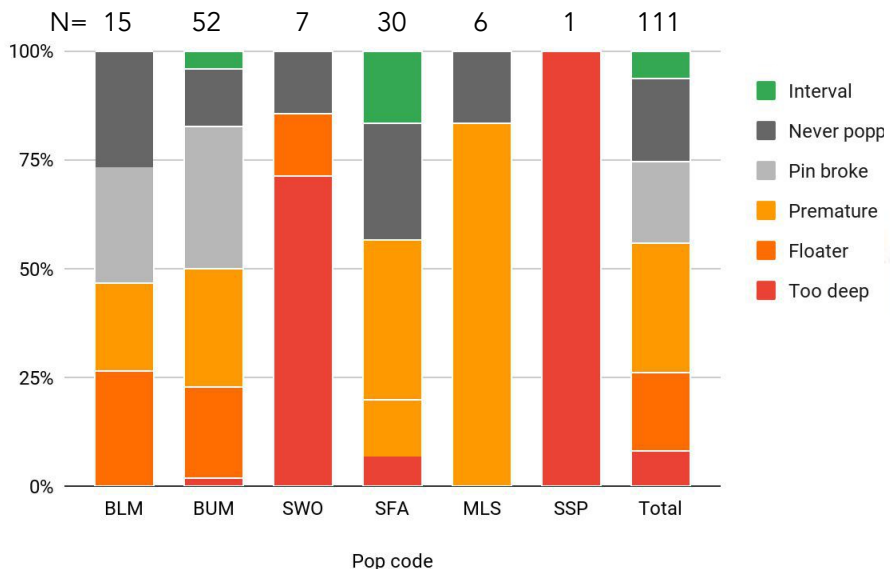
111 TAGS AROUND THE INDIAN OCEAN



NUMBER OF TAGS DEPLOYED BY SPECIES AND INDIAN OCEAN SITES (N=111 TOTAL)

111 TAGS AROUND THE INDIAN OCEAN

Tags programmed to pop after 3-12 months

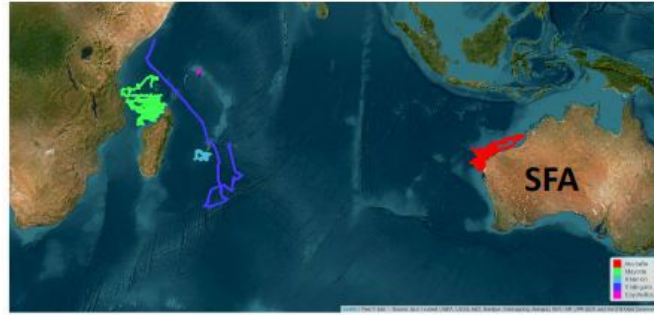
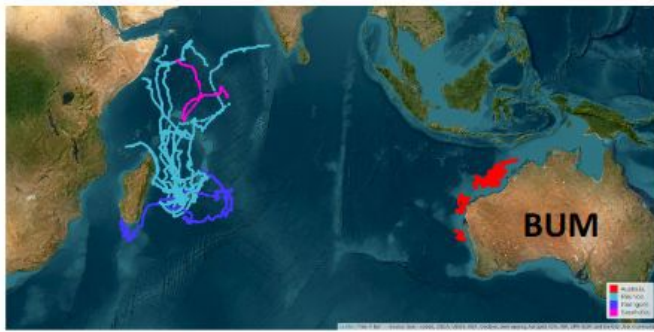


POP CODES OF TAGS DEPLOYED BY SPECIES.

TOO DEEP = LIKELY MORTALITY,
 FLOATER/PREMATURE = LIKELY MORTALITY/ANCHORING ISSUE
 PIN BROKE & NO INFORMATION = MANUFACTURING ERROR
 INTERVAL = RELEASED AS PROGRAMMED

HISTOGRAM of PROGRAMMED AND ACHIEVED DEPLOYMENT DURATION

MAX DEPLOYMENT: 300 DAYS
 AVERAGE DEPLOYMENT: 67 DAYS
 AVERAGE OF PROPORTION OF PROGRAMMED TIME: 36%
 TOTAL NUMBER OF DAYS AT SEA: 6415.5

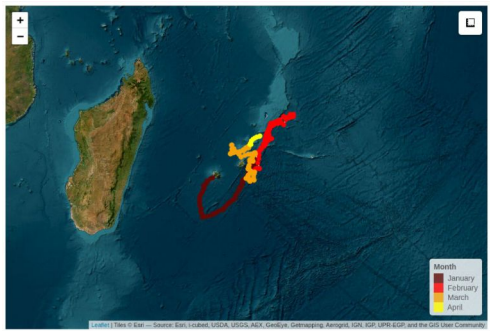
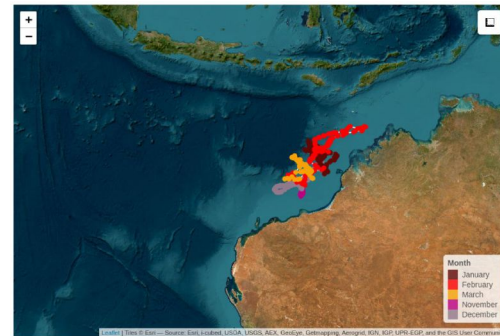
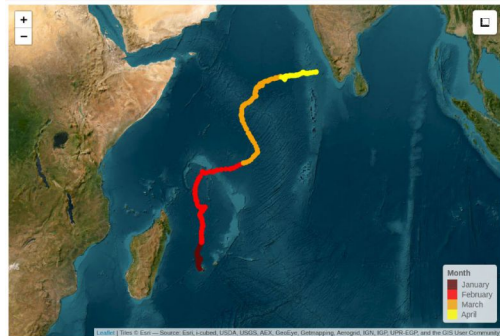
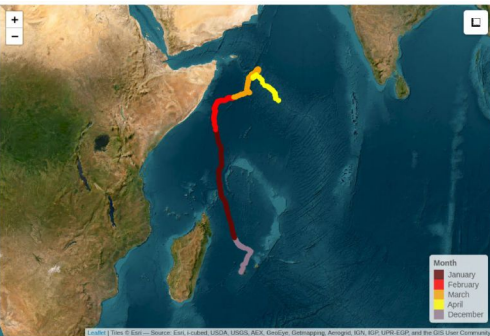


TRAJECTORIES SHOW DIFFERENT BEHAVIOURS BETWEEN EAST AND WEST

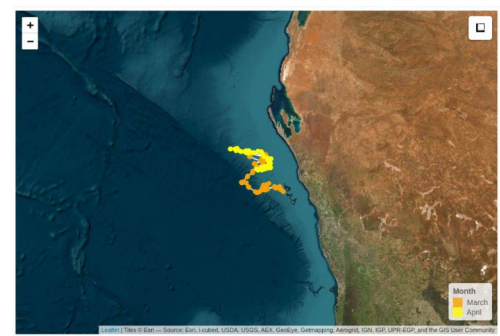
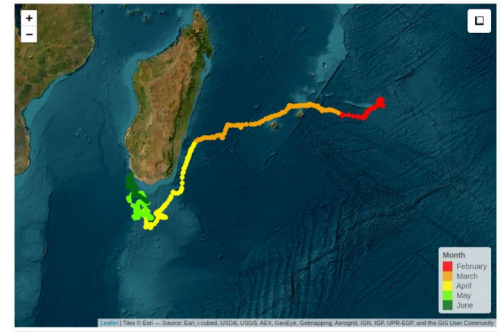
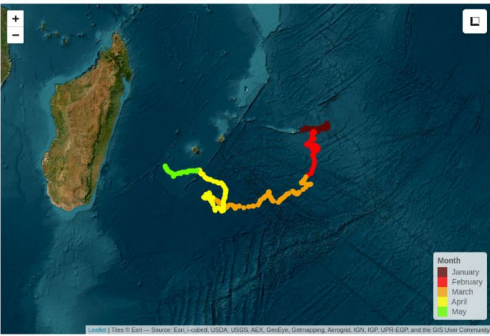
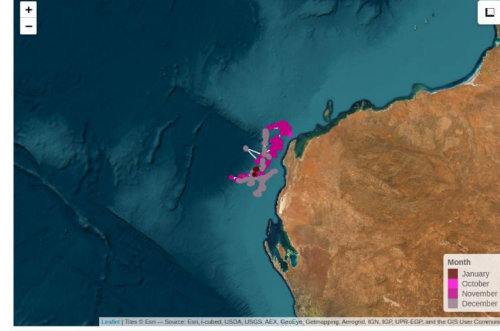
BUM

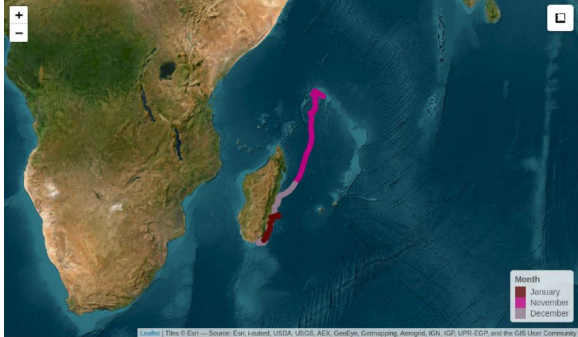
E-W DIVIDE IN BEHAVIOURS

EAST SIDE
HIGHER
RESIDENCY

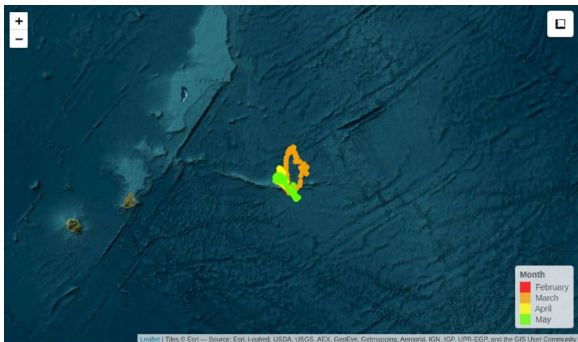


WEST SIDE VARIABLE,
MAJORITY S>N DURING
PRESUMED SPAWNING
PERIOD, BUT
SOME RESIDENCY, N>S

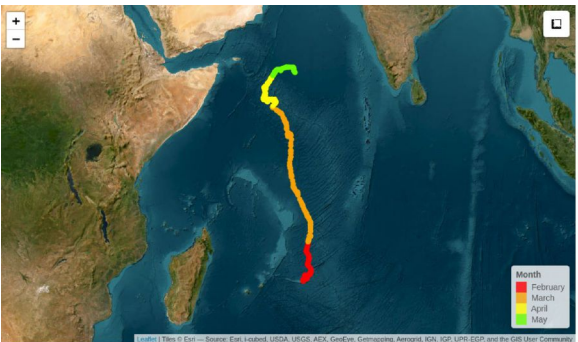




$N > S$



LITTLE
DISPLACEMENT

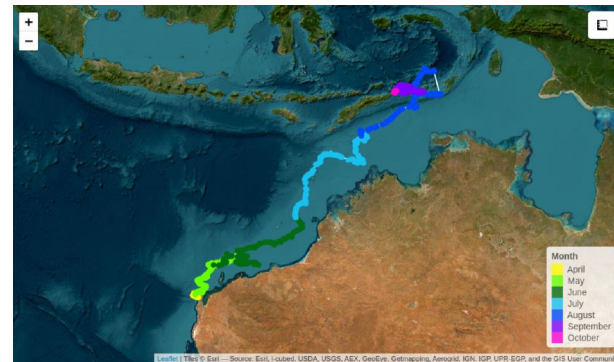


$S > N$

BLM

VARIABLE BEHAVIOR DURING
PRESUMED SPAWNING PERIOD
(NOV-MAR) IN WEST

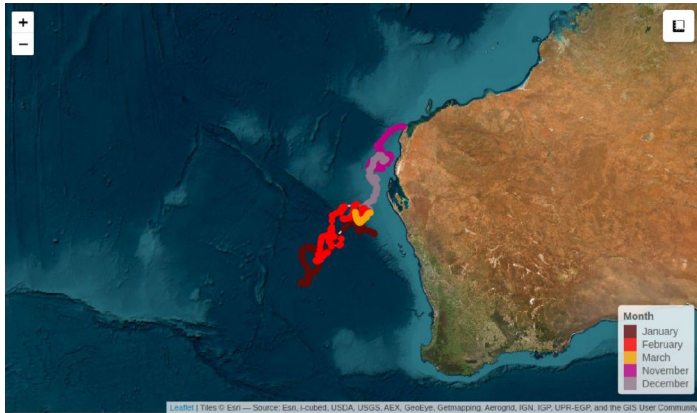
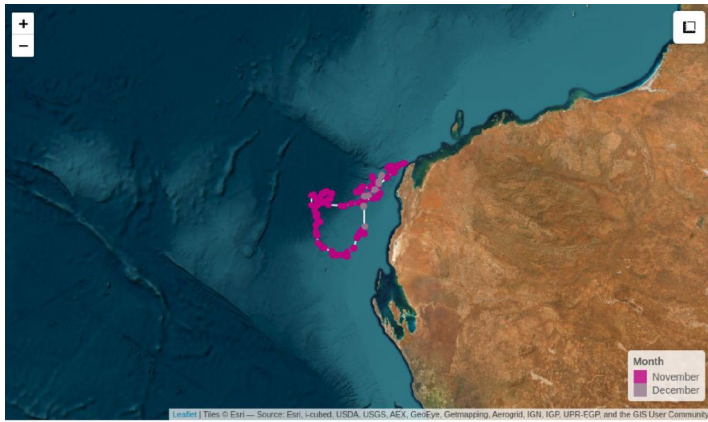
MIGRATION THRU INDONESIA IN EAST



MLS

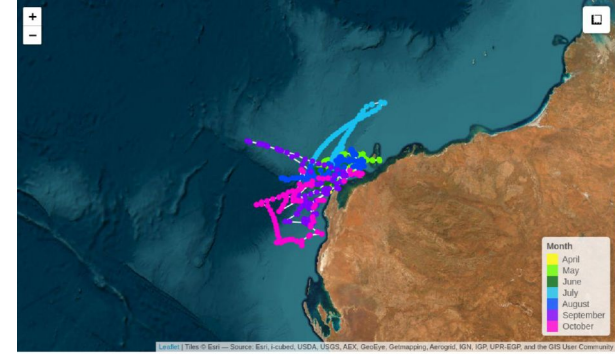
ALL TAGS IN EAST BASIN
REMAIN ON/NEAR SHELF

AND ONE POP AFTER 1 YEAR WITHOUT
DATA TRANSMISSION OFFSHELF

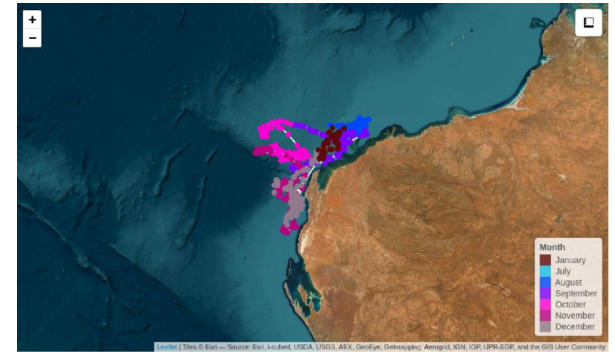


SFA

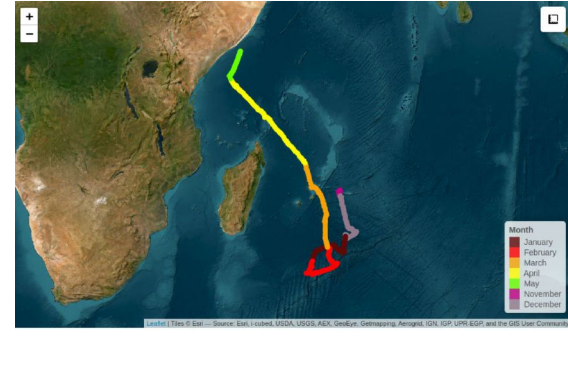
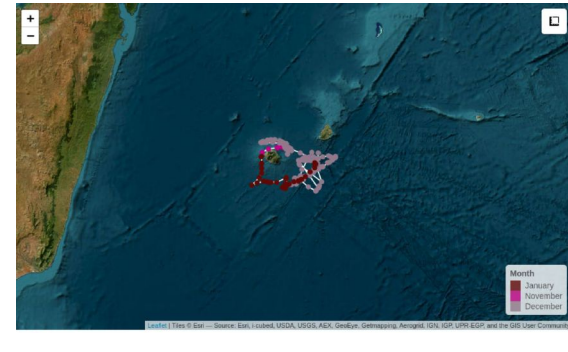
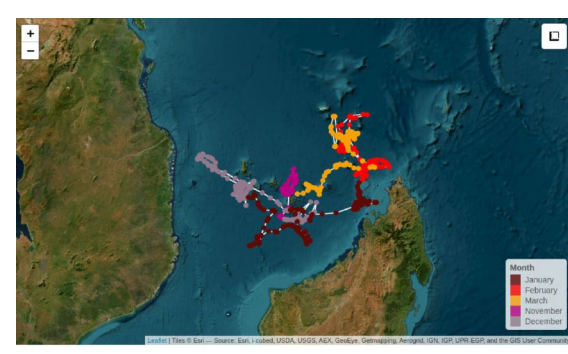
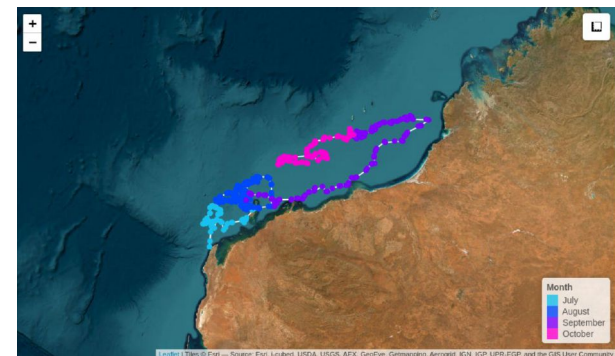
HIGH RESIDENCY
AROUND
MAYOTTE/COMOROS



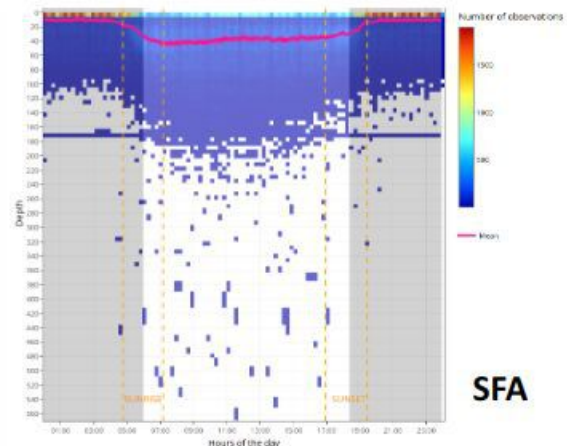
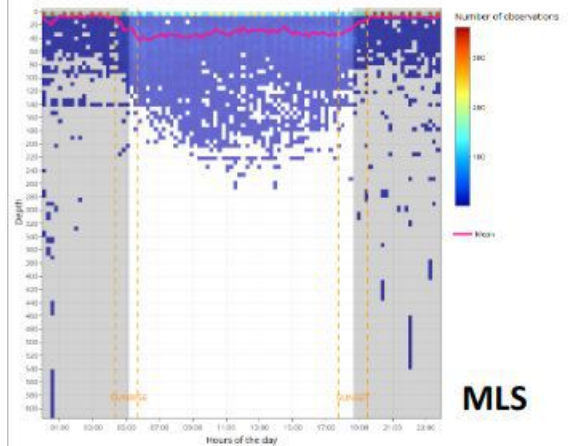
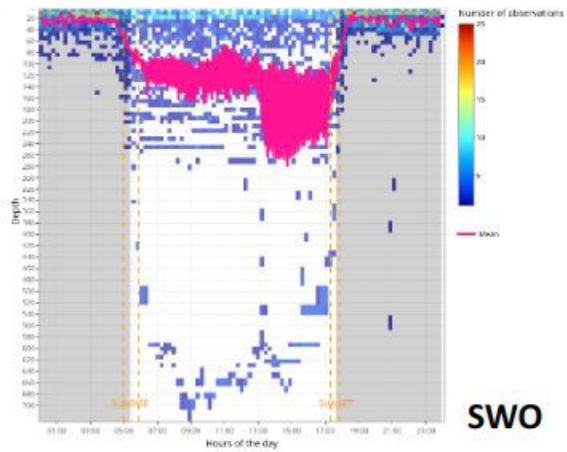
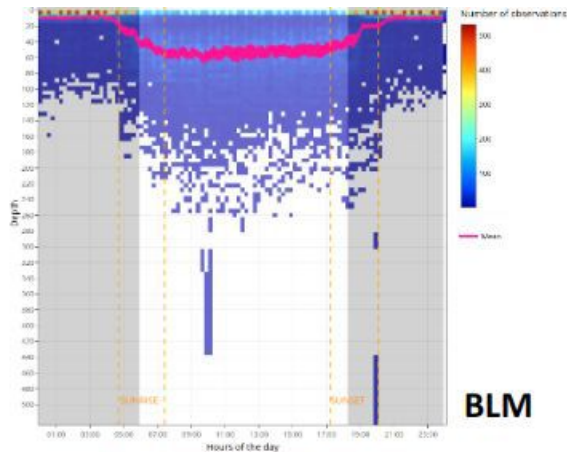
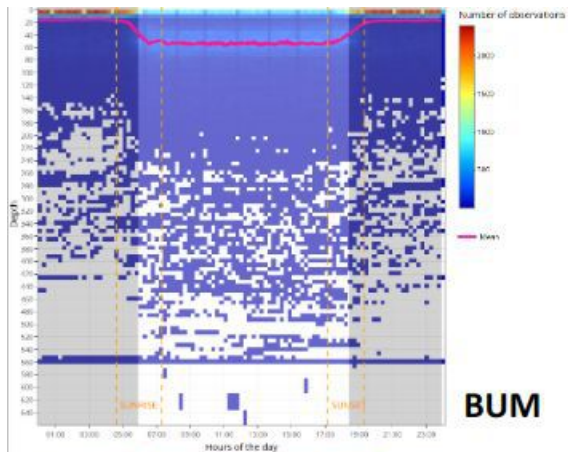
REUNION ALL TAGS IN EAST
BASIN REMAIN
ON/NEAR SHELF



LARGE
DISPLACEMENTS
OBSERVED



HOUR OF THE DAY

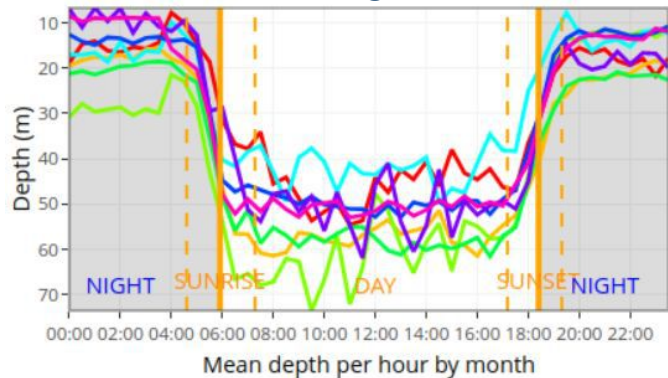


DIEL VERTICAL MIGRATION OBSERVED FOR ALL SPECIES

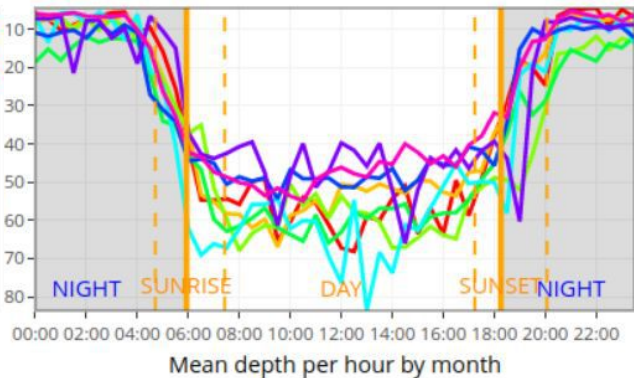
SPECIES	DAYTIME DEPTH (M)	NIGHTTIME DEPTH (M)
SWO	100-250	20-40
BUM, BLM	60	10-20
MLS, SFA	40	10-20

DEPTH (M)

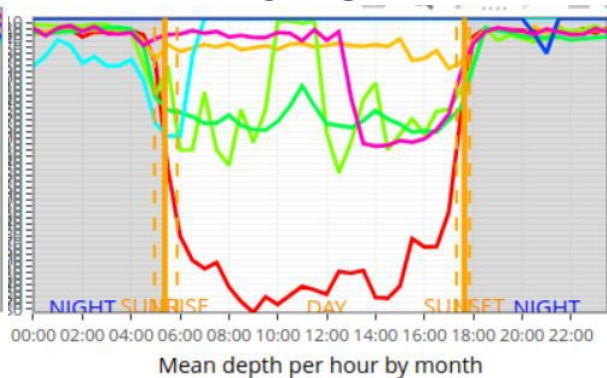
BUM



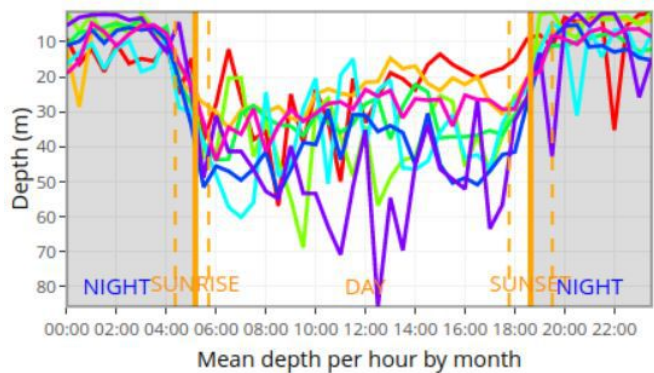
BLM



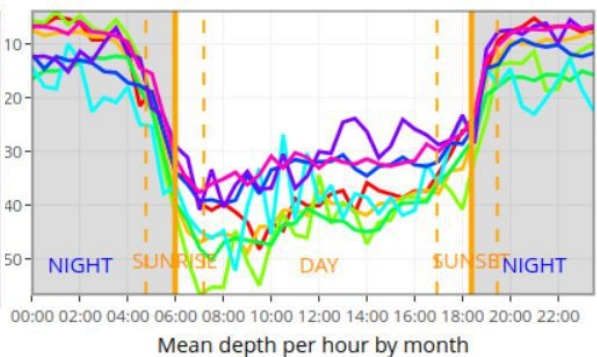
SWO



MLS



SFA



- New Moon
- Waxing Crescent
- First Quarter
- Waxing Gibbous
- Full Moon
- Waning Gibbous
- Last Quarter

LITTLE EFFECT OF MOONPHASE

111 TAGS AROUND THE INDIAN OCEAN

VARIABLE BEHAVIOURS BETWEEN SPECIES, BASINS

WEST BASIN SHOWS HIGHER VARIABILITY IN HORIZONTAL DISPLACEMENTS

- NORTHWARD MIGRATION TO PRESUMED SPAWNING AREA OFF SOMALIA
 - MOST OBSERVED IN BUM
- SOUTHWARD MIGRATIONS TOWARDS FEEDING GROUNDS
 - BUM, BLM
- RESIDENT BEHAVIOR, SMALL HORIZONTAL DISPLACEMENTS
 - ALL SPECIES, PARTICULARLY SFA

EAST BASIN TAGS STAY PRIMARILY ON/NEAR CONTINENTAL SHELF

- POTENTIALLY MIGRATION THRU INDONESIA (BLM)

DIEL VERTICAL MIGRATION SIMILAR TO OTHER STUDIES

NO CLEAR EFFECT OF MOONPHASE

111 TAGS AROUND THE INDIAN OCEAN

CONCLUSIONS

EXPENSIVE, HIGH EFFORT, and CAPACITY INVESTMENT

MANY TAG FAILURES (battery issues, no reporting)

FEW DATA FOR STOCK ASSESSMENT PURPOSES (but indication of movement between regions)

MORE DATA REQUIRED (e.g. longer trajectories)

COMPLEMENTARY METHODS REQUIRED (e.g. genetic studies)

111 TAGS AROUND THE INDIAN OCEAN

CURRENT AND NEXT STEPS

IN-DEPTH ANALYSES (ECOLOGY, HABITAT, BEHAVIOUR)

POST-RELEASE MORTALITY INDICATOR

STANDARDISED TAGGING DATABASE (e.g. NIEBLAS et al. 2019; LAM et al 2011)

DATA PAPER - SUBMIT DATA FOR OPEN USE

THANK YOU TO OUR PARTNERS AND COLLABORATORS



THANK YOU TO SYMPOSIUM COORDINATORS

