Preliminary results of silky shark post release mortality experiments utilizing domestic longline vessels of Costa Rica and Ecuador

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TOPICS

- Logistical Considerations
- Experimental Design
- Preliminary Results

Logistical Considerations for Setting Up the Tagging Experiment

• Develop collaborations with scientific colleagues in Costa Rica and Ecuador with longline fleets of initial interest in which to conduct tagging experiments

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- Prepare materials and schedule training for observers/scientists whom will be doing the tagging, including: a) shark species identification guide, b) tag release data sheets and instructions, c) digital cameras for recording each shark tagging event, d) tagging applicator and anchor placement instructions, and e) guarantee a financial reward to the observers/scientists for each shark properly tagged with all required data recorded, and photographs and/or video of the tagging event

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- Sharks should be classified as alive and in good condition at the time they are released if all of the following criteria are met: 1) The shark was classified as AG at the time it was landed, 2) shark still appears lively and active, 3) no bleeding, and 4) shark swims away. Otherwise the shark should be classified as alive but injured

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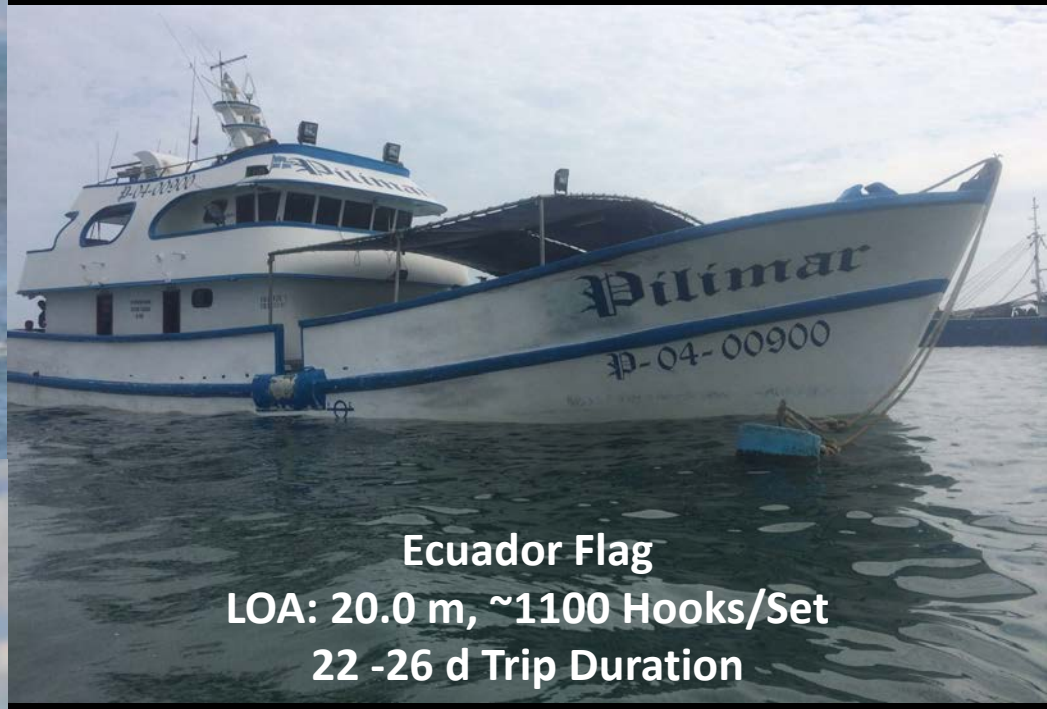
- Survival or mortality events to be determined by using the depth and temperature records transmitted from mini-PATs and received through Argos

Tagging Vessels

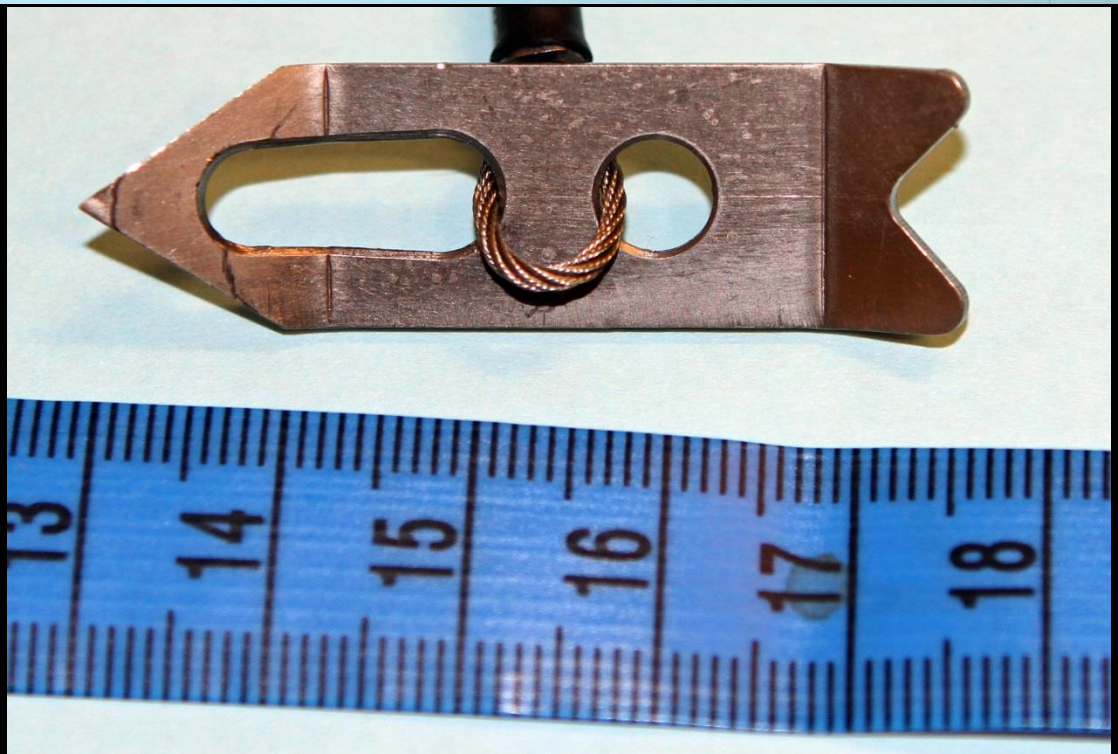
Costa Rica Flag
LOA: 15.4 m, ~1600 Hooks/Set
17 d trip duration



Ecuador Flag
LOA: 20.0 m, ~1100 Hooks/Set
22 -26 d Trip Duration

Costa Rica Flag
LOA: 11.4 m, ~600 Hooks/Set
13d Trip Duration

Wildlife computers MiniPAT, Applicator, and Titanium Anchor



Silky shark handling and tagging video

Sampling Parameters for deployed MiniPATs

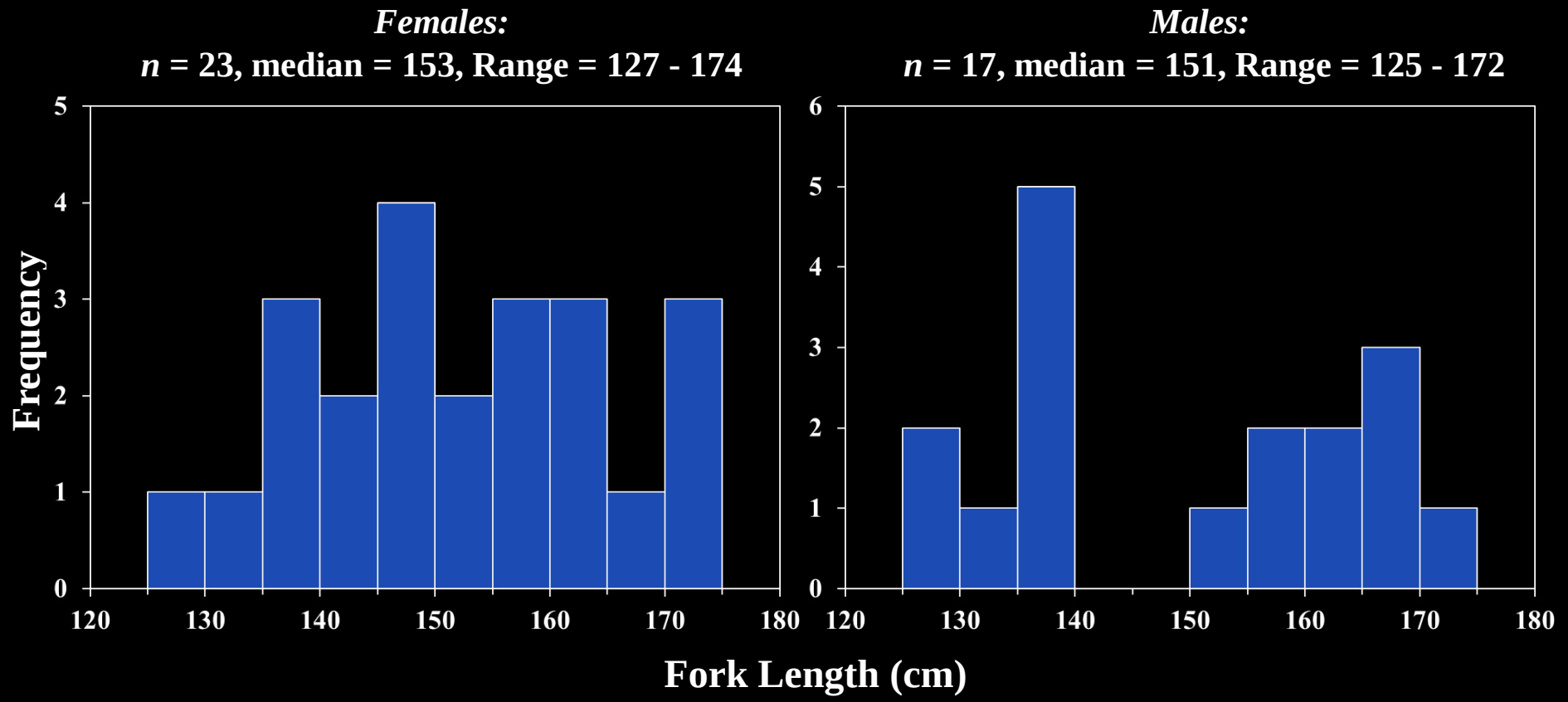
		90 Day Deployment	180 day Deployment
Daily messages	Message type	Action	Action
	Light level geolocation messages	Always Transmit	Always Transmit
	Daily data messages	Never Transmit	Never Transmit
Time series			
	Depth Messages	Always Transmit	Always Transmit
	Temperature Messages	Always Transmit	Always Transmit
	Sampling Interval	300 seconds	600 seconds
Summary messages			
	Mixed Layer Temperature Messages	Always Transmit	Always Transmit
	Histogram Messages	Never Transmit	Never Transmit
	Depth-Temperature Profile Messages	Always Transmit	Always Transmit
	Summary period	24 hours	24 hours
Initiation and alternate release variables			
	Initiation Depth	10 m	10 m
	Max Depth	1700 m	1700 m
	Constant depth duration	1 d range ±2.5m	1 d range ±2.5m

Silky Shark Tagged with a MiniPAT

SILKY SHARK TAGGING FORM

- PSAT serial number: 15P0448
- PSAT PTT number: 158453
- Taggers name: Daniel Bermúdez Mora
- Vessel name: Lobo del Mar
- Date and time of set: 26-08-2016 06:35 A.M.
- Date and time of release: 27-08-2016 09:25 A.M.
- Release location Latitude (N or S): 05°03.847 N Longitude: 90°22.200 W
- Hook type (J or circle) and size: Circle 14/0
- Hooked location (mouth, gills, or deep in throat or stomach): Mouth
- Hook removed (yes or no): NO
- Sex (male or female): Male
- Fork Length (tip of snout to fork of tail): 167 cm
- Condition when landed (Alive good or alive injured): Alive good
- Photograph of tagged shark (yes or no): yes
- Condition at release (Alive good or Alive injured): Alive good
- Time on deck before release: 02:05
- Sea state (calm, moderate, or rough): Moderate
- Sea surface temperature: NA
- Comments: Sea state was calm to moderate
  Sunny conditions

Length frequency distributions for Female and Male sharks released with miniPATs



Results from 19 MiniPAT Deployments on Silky Sharks from Costa Rica

Date Released	Fork Length (cm)	Sex	Hook Type	Hook Location	Hook Removed	Days Until Reporting	Fate	Pop-off Reason
4/16/2016	168	M	T	Mouth	No	33	Survivor	Tether Failure
4/19/2016	138	M	T	Mouth	Yes	50	Survivor	Pin Broke
4/21/2016	162	F	T	Mouth	No	NA	Indeterminate	Did not Transmit
4/21/2016	136	F	T	Mouth	Yes	25	Survivor	Attachment Failure[1]
4/21/2016	127	F	T	Mouth	Yes	86	Survivor	Attachment Failure[1]
8/25/2016	147	F	C	Mouth	Yes	67	Survivor	Attachment Failure[1]
8/25/2016	163	F	C	Mouth	No	64	Survivor	Attachment Failure[1]
8/25/2016	138	M	C	Mouth	No	83	Survivor	Attachment Failure[1]
8/27/2016	164	M	C	Mouth	No	60	Survivor	Attachment Failure[1]
8/27/2016	167	M	C	Mouth	No	76	Survivor	Attachment Failure[1]
8/27/2016	148	F	C	Mouth	No	25	Survivor	Attachment Failure[1]
11/30/2016	130	M	C	Mouth	Yes	137	Survivor	Pin Broke
12/7/2016	125	M	C	Mouth	No	90	Survivor	Full Duration
12/7/2016	139	M	C	Mouth	No	90	Survivor	Full Duration
12/7/2016	136	M	C	Mouth	No	90	Survivor	Full Duration
12/9/2016	174	F	C	Mouth	Yes			
12/9/2016	172	M	C	Mouth	No			
12/9/2016	134	F	C	Mouth	No			
12/9/2016	143	F	C	Mouth	No	90	Survivor	Full Duration

[1]Attachment Failure refers to either a failure in the OEM tether or a failure in anchor retention

Results from 21 MiniPAT Deployments on Silky Sharks from Ecuador

Date Released	Fork Length (cm)	Sex	Hook Type	Hook Location	Hook Removed	Days Until Reporting	Fate	Pop-off Reason
3/19/2016	168	M	J	Mouth	Yes	6	Indeterminate	Attachment Failure[1]
3/19/2016	127	M	J	Throat	No	10	Indeterminate[2]	Attachment Failure[1]
3/19/2016	171	F	J	Mouth	No	5	Indeterminate	Attachment Failure[1]
3/26/2016	157	F	J	Mouth	Yes	12	Indeterminate	Attachment Failure[1]
3/27/2016	135	F	J	Mouth	No	19	Indeterminate	Attachment Failure[1]
6/21/2016	153	F	J	Mouth	No	177	Survivor	Full Duration
6/21/2016	170	F	J	Mouth	No	20	Mortality	Too Deep
6/21/2016	161	F	J	Mouth	Yes	90	Survivor	Full Duration
6/25/2016	163	M	J	Mouth	No	118	Survivor	Pin Broke
6/28/2017	148	F	J	Mouth	No	103	Survivor	Pin Broke
1/16/2016	155	M	J	Mouth	No			
4/2/2017	151	M	J	Throat	No	1	Mortality	Too Deep
4/2/2017	141	F	J	Mouth	Yes			
4/2/2017	167	F	J	Mouth	No			
4/2/2017	157	M	J	Mouth	No			
4/2/2017	155	F	J	Mouth	Yes			
4/2/2017	148	F	J	Mouth	No			
4/5/2017	138	M	J	Mouth	No			
4/6/2017	158	F	J	Mouth	No			
4/10/2017	139	F	J	Mouth	Yes			
4/11/2017	154	F	J	Throat	No			

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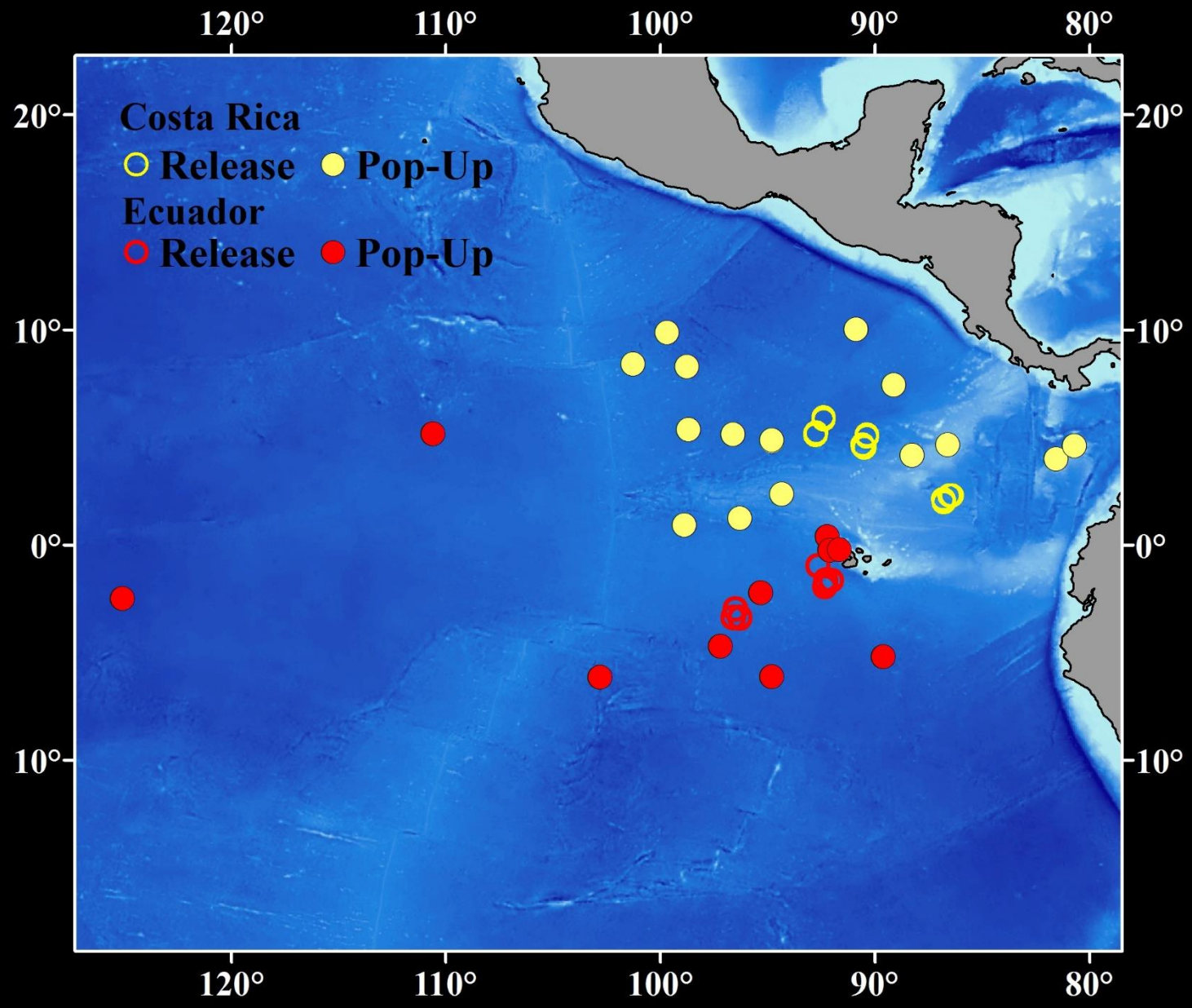
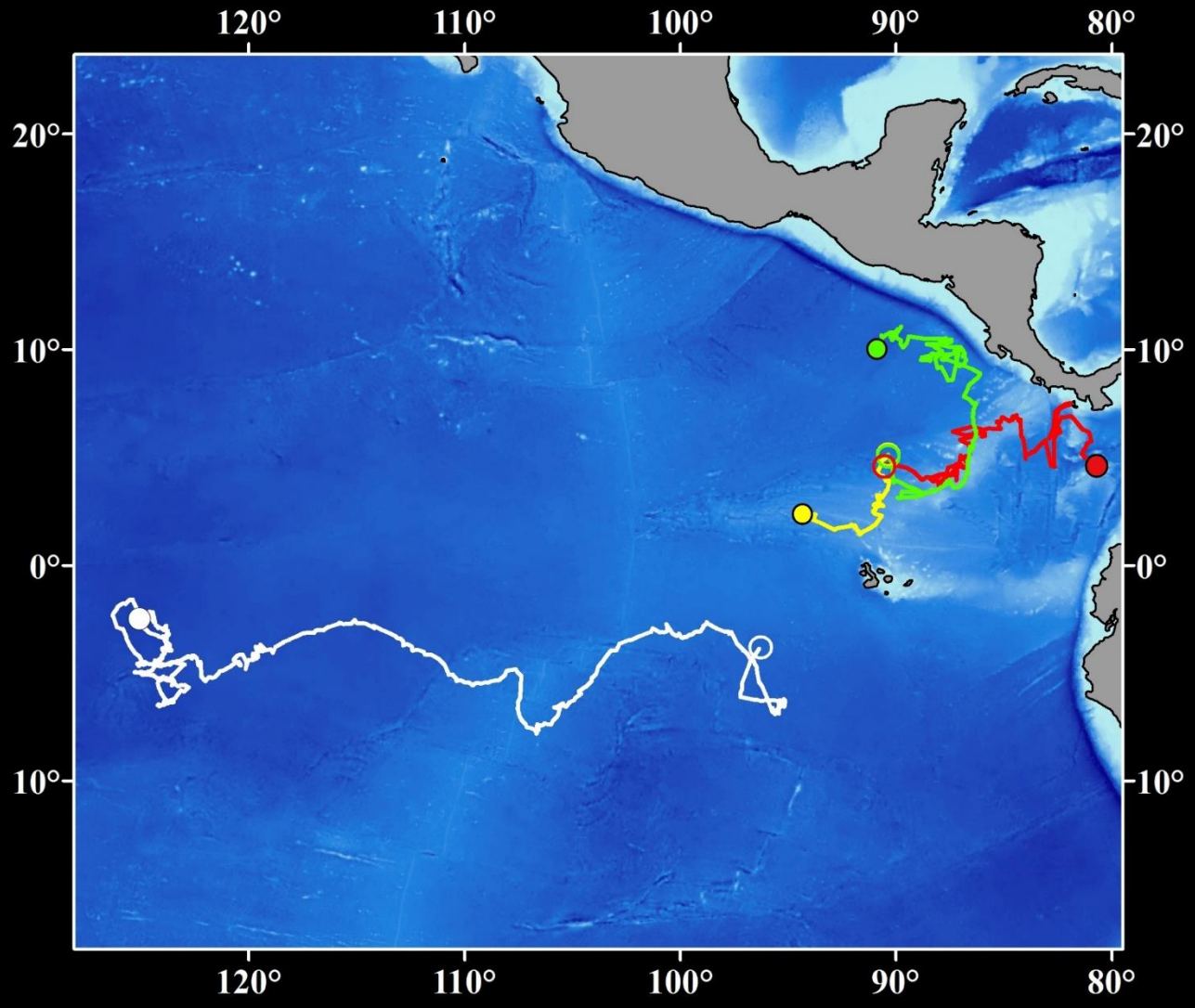
[2] Alive injured when landed; hook deep in mouth

Release (30) and Pop-up (26) Locations for miniPATs deployed on Silky Sharks



Maximum likelihood tracks derived from a state-space model using time-discrete gridded (0.25° x 0.25°) probability surfaces for 4 silky sharks, showing the furthest northward (76 d, 300 nm) southward (25 d, 289 nm), eastward (67 d, 589 nm), and westward movements (180 d, 1725 nm)



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- The movements and dispersion of silky sharks, based on miniPAT pop-up locations were: greatest northward movement 300 nm in 76 d, from a deployment at 5°04 N 90°22 W; greatest southward movement of 289 nm in 25 d, from a deployment at 5°06 N 90°23 W; greatest westward movement of 1725 nm in 180 d, from a deployment at 3°23 S 96°17 W; and greatest eastward movement of 589 nm in 67 d from a deployment at 4°35 N 90°33 W .

SUPPLEMENTARY INFORMATION

- The EU has implemented through DG MARE an action grant of €250,000 for IATTC to conduct further experiments and research for identification of mitigation measures for silky sharks in the EPO

- A formal proposal is requested from IATTC describing the research plan

- Currently we are considering research options which will be evaluated as to their scientific merit and application to the objectives specified by EU

- We are scheduling to submit the formal proposal to the EU by September 2017, and hopefully begin experiments in early 2018

Acknowledgements

- Extra budgetary funding to IATTC from EU, with co-financing from ISSF
- INCOPESCA Costa Rica
- SRP Ecuador
- WWF Ecuador
- Captains and crews aboard the Ecuadorian and Costa Rican flagged longline vessels utilized for tagging