

Post-release mortality and behavior of Greater Amberjack in the northern Gulf of Mexico from recreational fishing



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Background – Greater Amberjack (*Seriola dumerilii*)

Greater Amberjack (SEDAR 2020)

Overfished

Experiencing overfishing

Size restrictions and seasonal closures

Increases likelihood

- releasing short, sub-adult fish during open season**
- adults and sub-adults during closed season**



Predicting mortality of recreational discards

Risks of mortality of released fish

Injury from tackle

Exhaustion

Barotrauma from rapid ascent

Depredation



Predicting mortality of recreational discards

Jackson et al. 2018 study

Two artificial reef sites, 50 m, 70 m

Fish caught with recreational gear – September 2014

36 GAJ tagged with acoustic depth sensor tags

Vented sb, all fish released at the surface

PRM estimated at 18.8%

Release condition sole significant predictor of PRM in Cox Proportional Hazards regression



Sub-lethal impacts

Changes in activity level

**Changes in position in the
water column**

depth use of fish



Study design – acoustic sensory telemetry

Innovasea sensor tags used to determine fate of fish following release

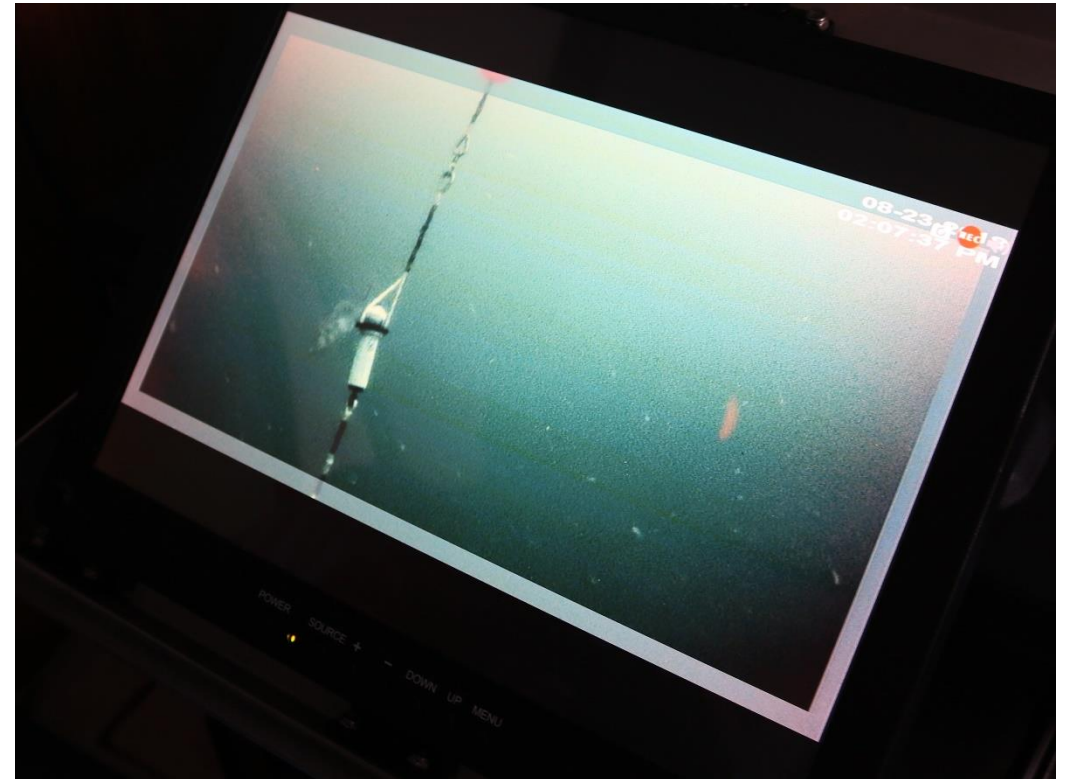
Depth

Tail beat accelerometry

Recreational fishing methods

Live bait

Jigging



Study design – data

Site depth

Water temp, dissolved oxygen, salinity

Fight time

Fish Size

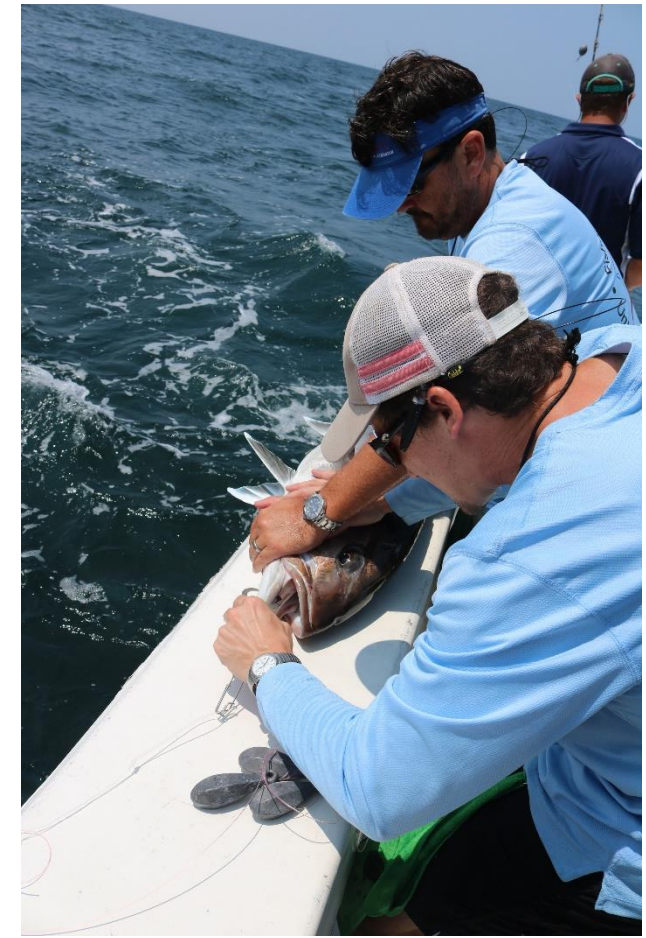
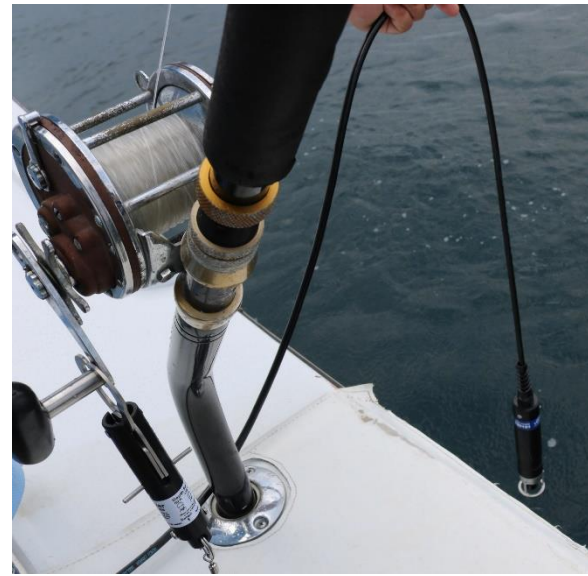
Handling time

Release treatment

descender device – Seaqualizer

GoPro camera recording release

surface release



Study design – tagging efforts

August 2018 (8/16-8/17, 8/23-8/24)

Transmitter glued to a stainless steel dart tag
Secondary nylon tag
23 fish tagged



April - May 2019 (4/30, 5/13-5/14) and August 2020 (8/17–8/18, 8/21-8/22)

Transmitters placed in peritoneal cavity, caudal end
Secondary nylon tag
22 fish tagged – 2019
23 fish tagged - 2020



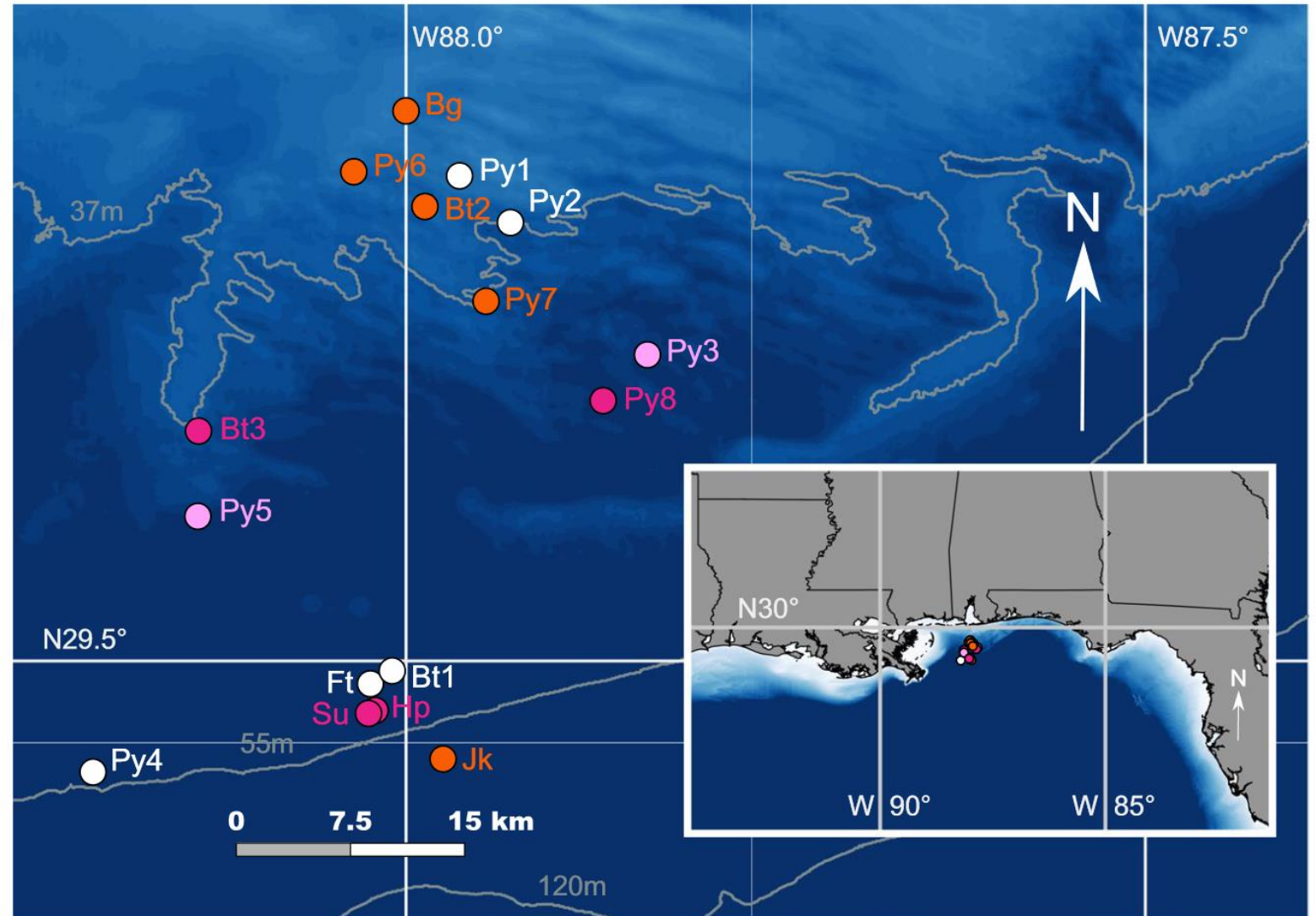
Study design – acoustic receiver and fishing sites

2018

2019

2020

2019 & 2020



Results – post release fate

Pre-landing

**depredation, severe fishing injury,
propeller injury**

Capture-handling mortality

Post-release mortality



Results – mortality

AVM – at vessel mortality (pre-landing):

depredation, severe fishing injury, propeller injury

CHM - Capture-handling mortality

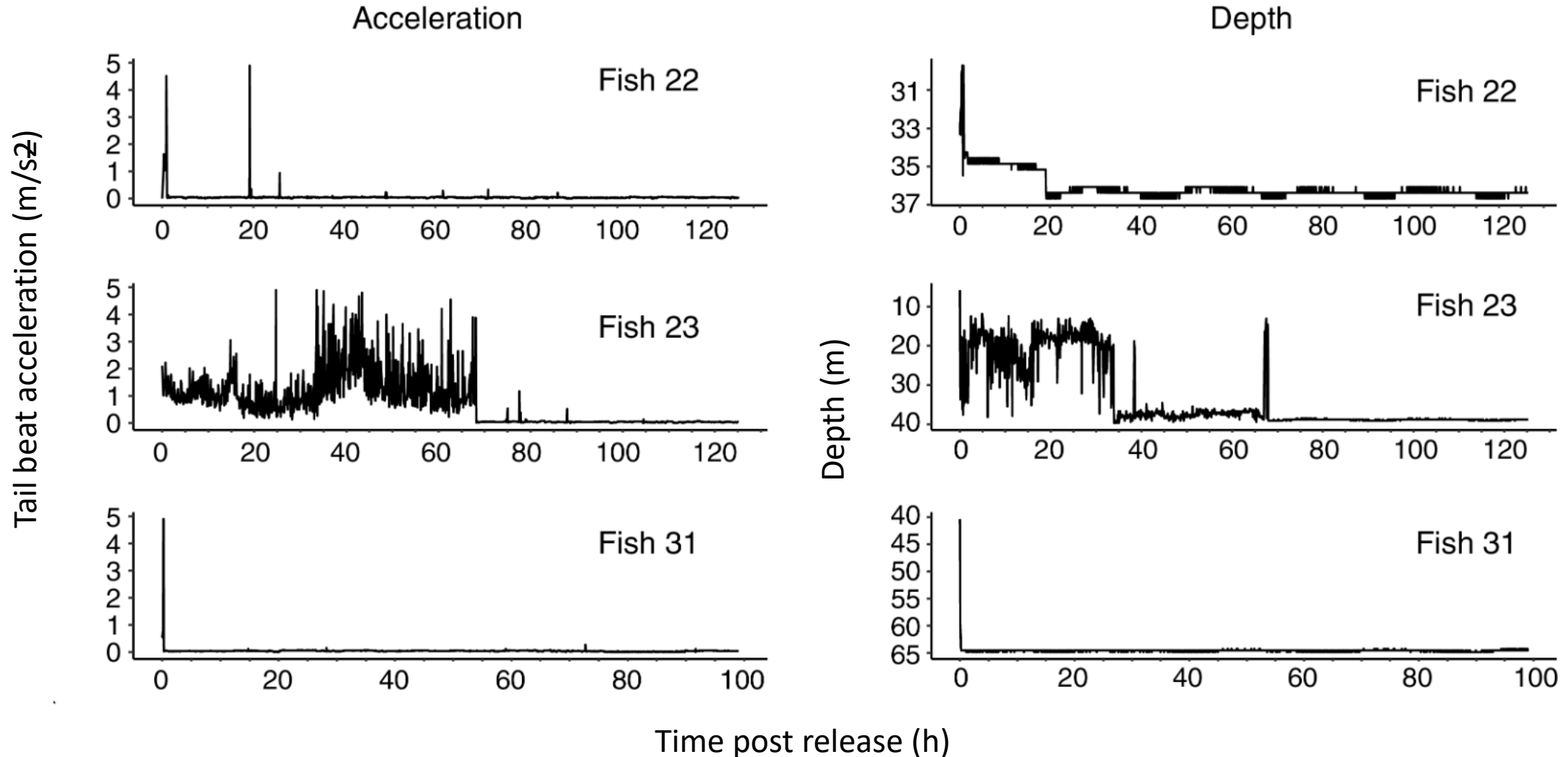
dead on vessel or at surface

PRM - Post-release mortality

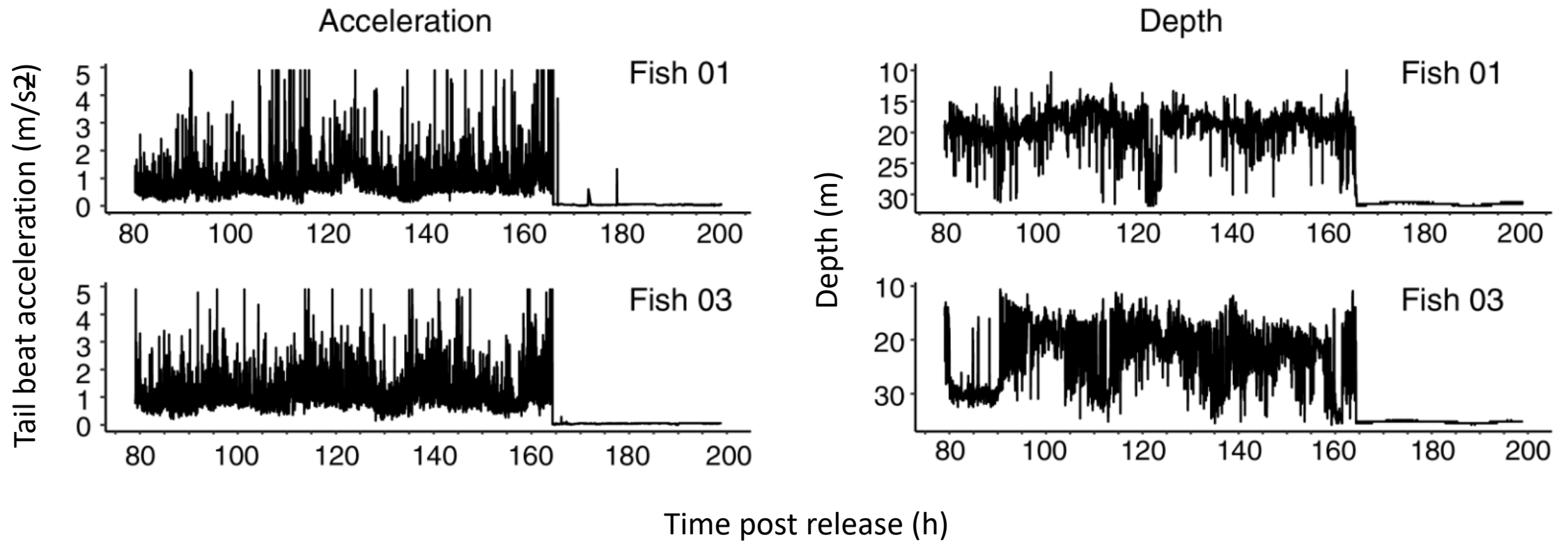
fish alive when released



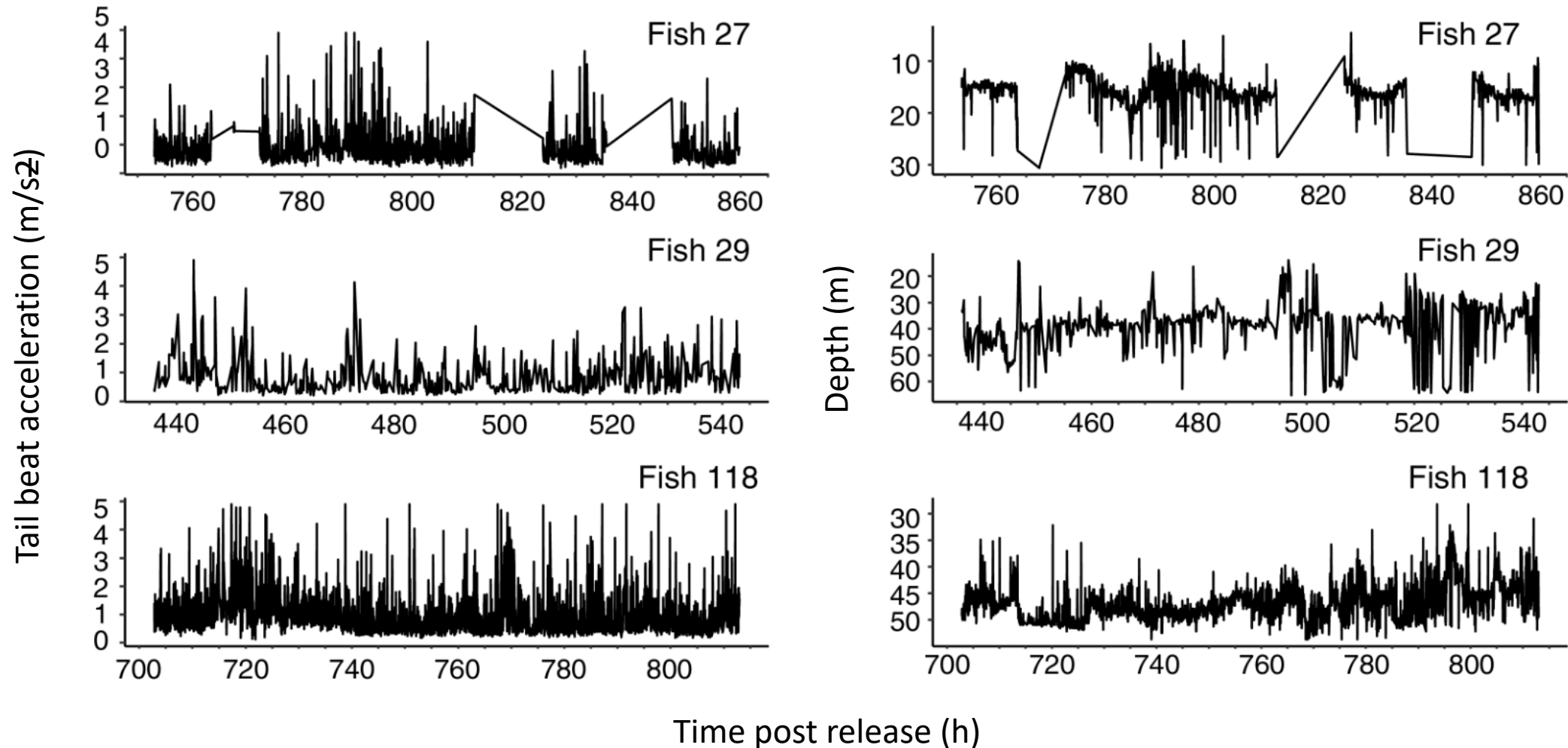
Results – post release mortality



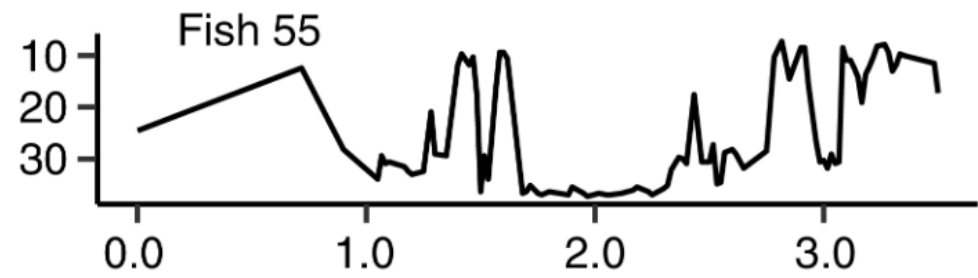
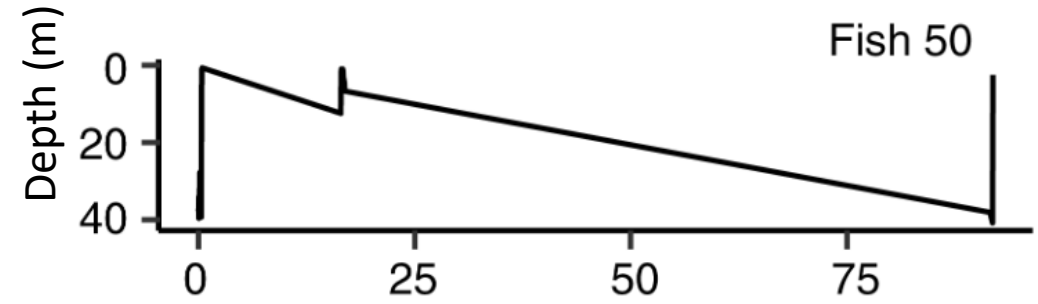
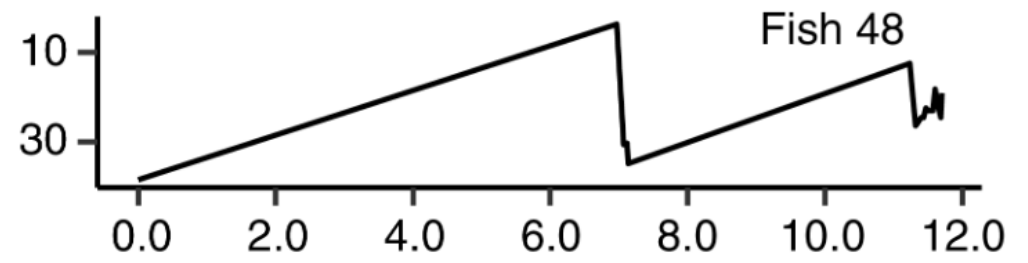
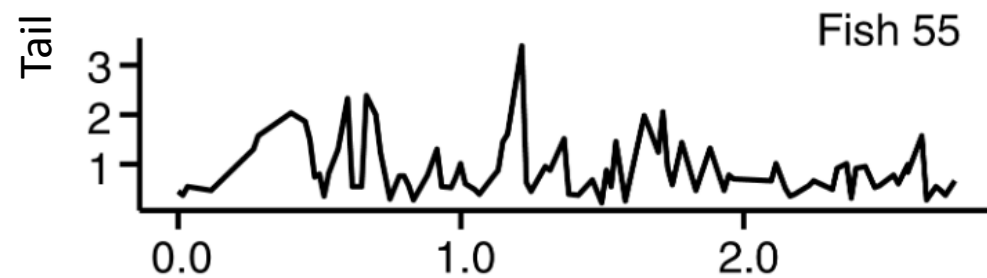
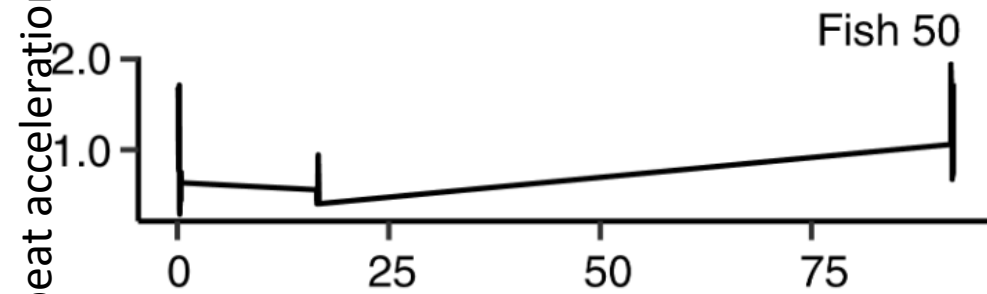
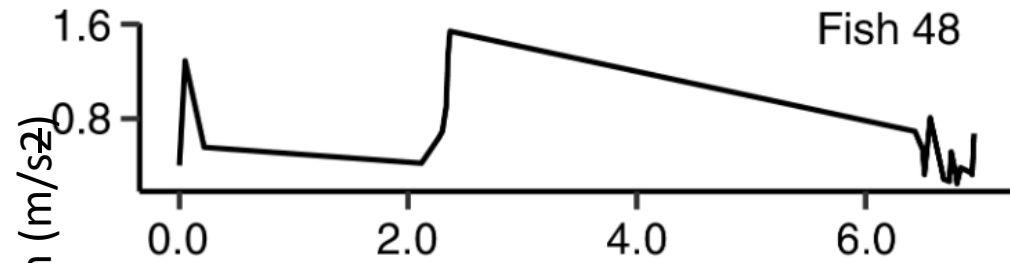
Results – shed tags 2018



Results – fish that survived until last observation



Results - emigrations



Time post release (h)

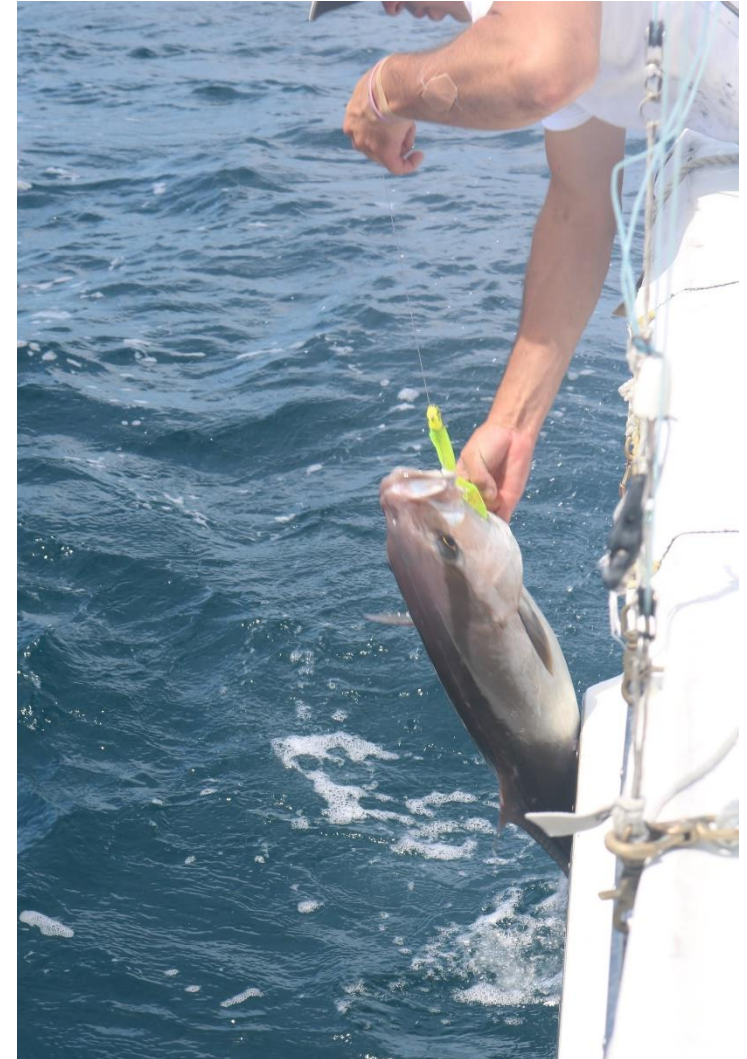
Results

Survivorship overall – 85%

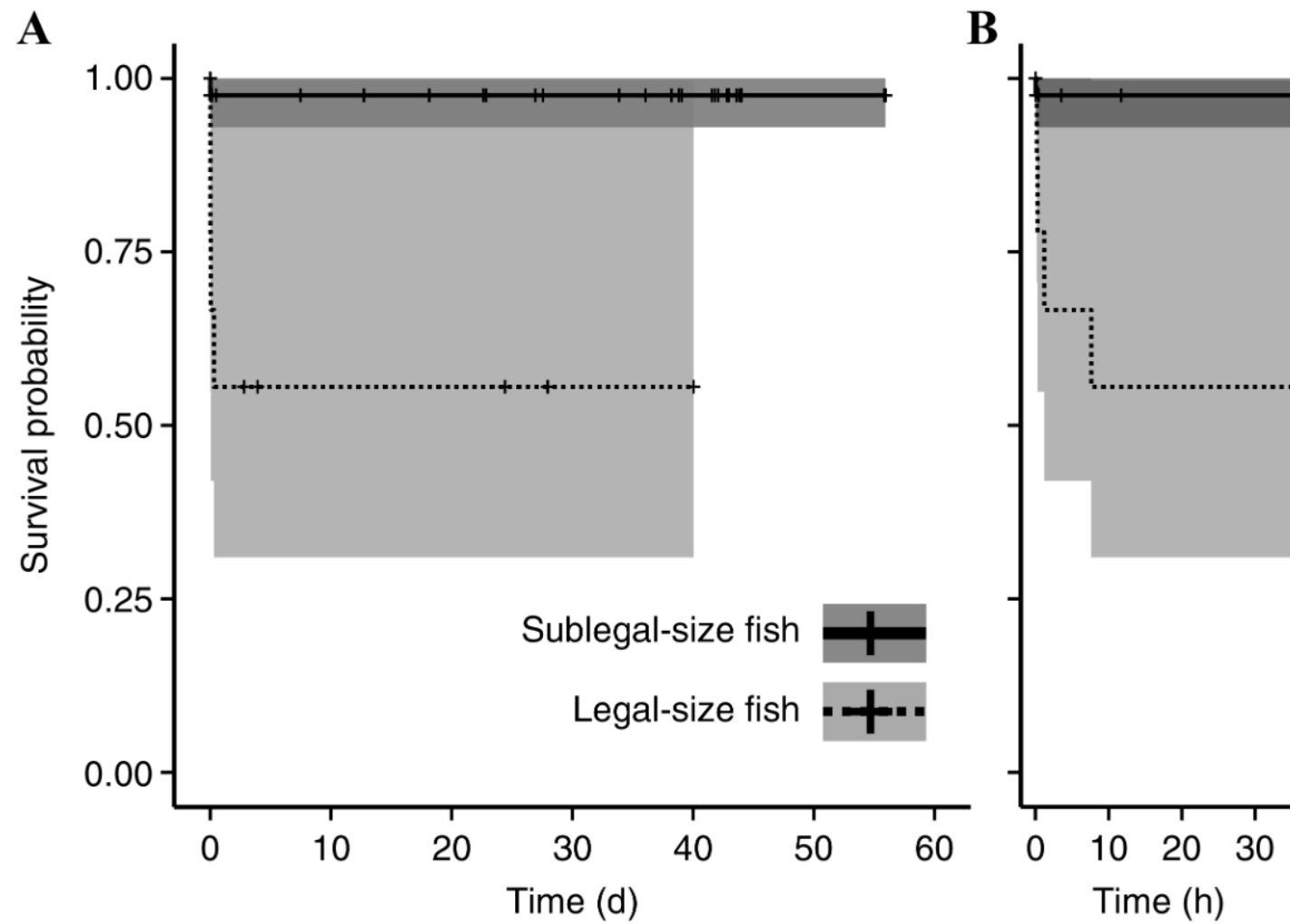
Survivorship after AVM and CHM – 95%

After PRM – 89% survivorship

Recapture rate from anglers – 12%



Results



Results

Mortality rates estimated from internally tagged fish only

PRM – much higher for legal fish

44% mortality legal

2% sub-legal fish

Results

Barotrauma did not appear to be a major factor within the depth range of the present study (< 65 m)

Factors not found to predict PRM

site depth

release treatment

Use of a descender did not increase risk of PRM either



Post release behavior of fish that survived

Depth and swimming activity averaged and binned by hour

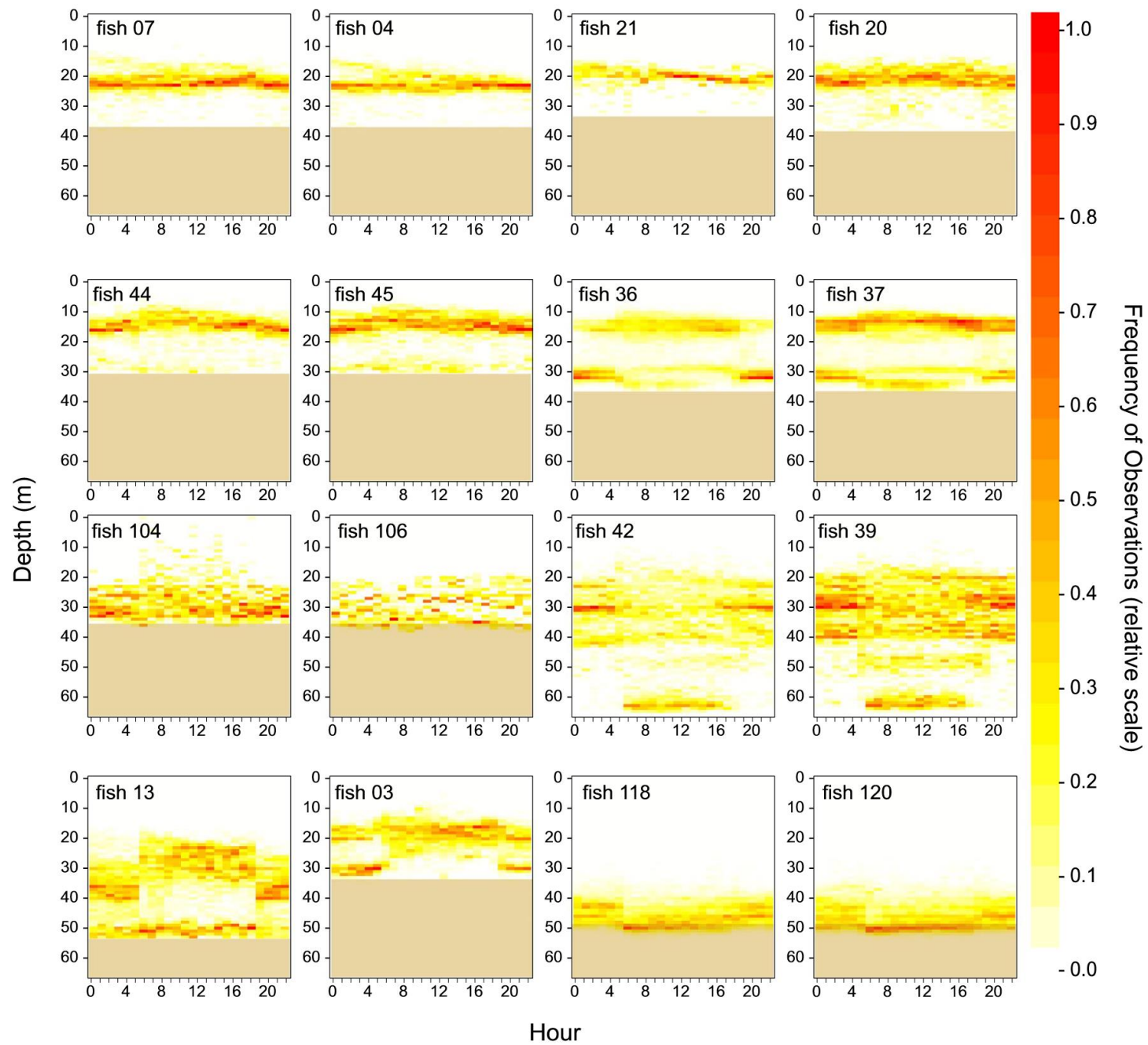
Diel patterns examined across the study period

Diel matrices constructed for each fish: depth x hour, activity x hour

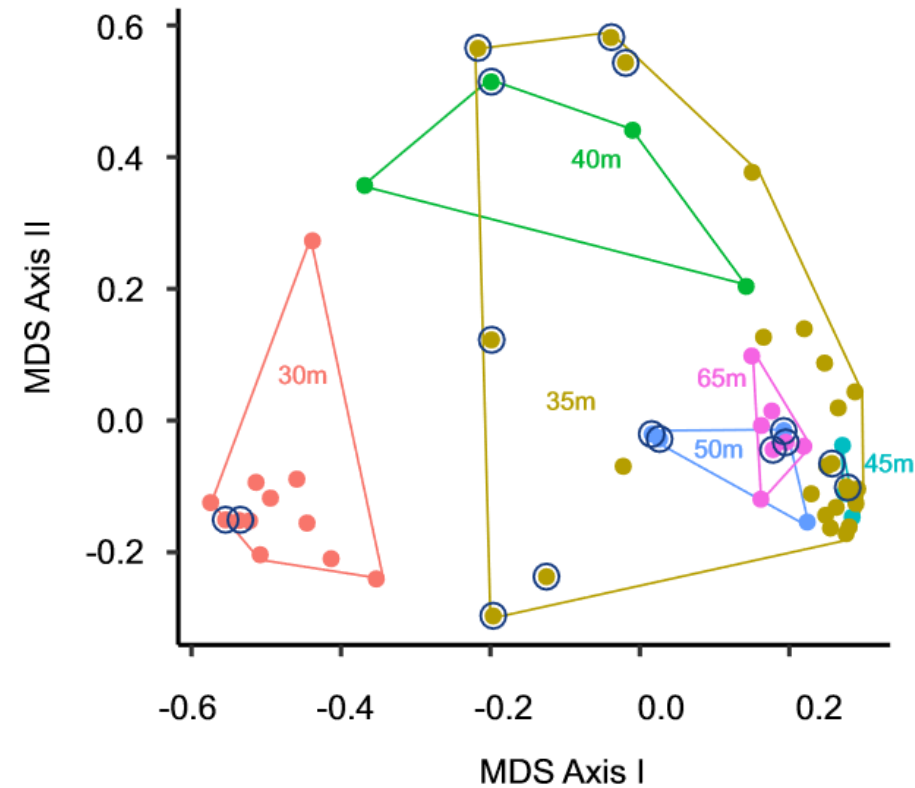
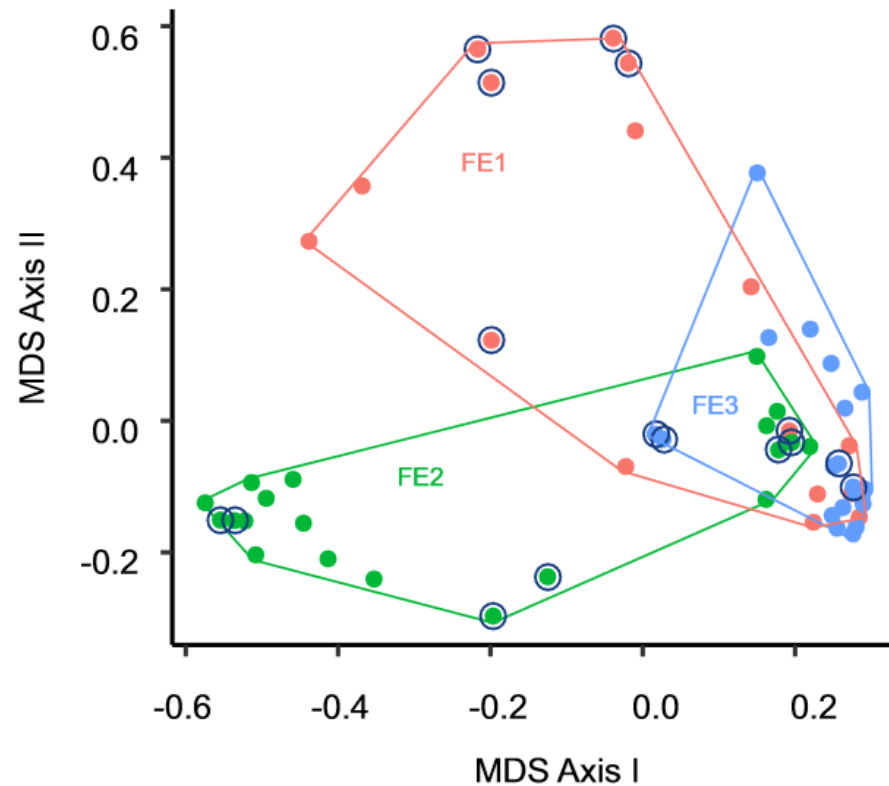
similarity among individuals calculated (matrix similarity index)

for depth & swimming

Results

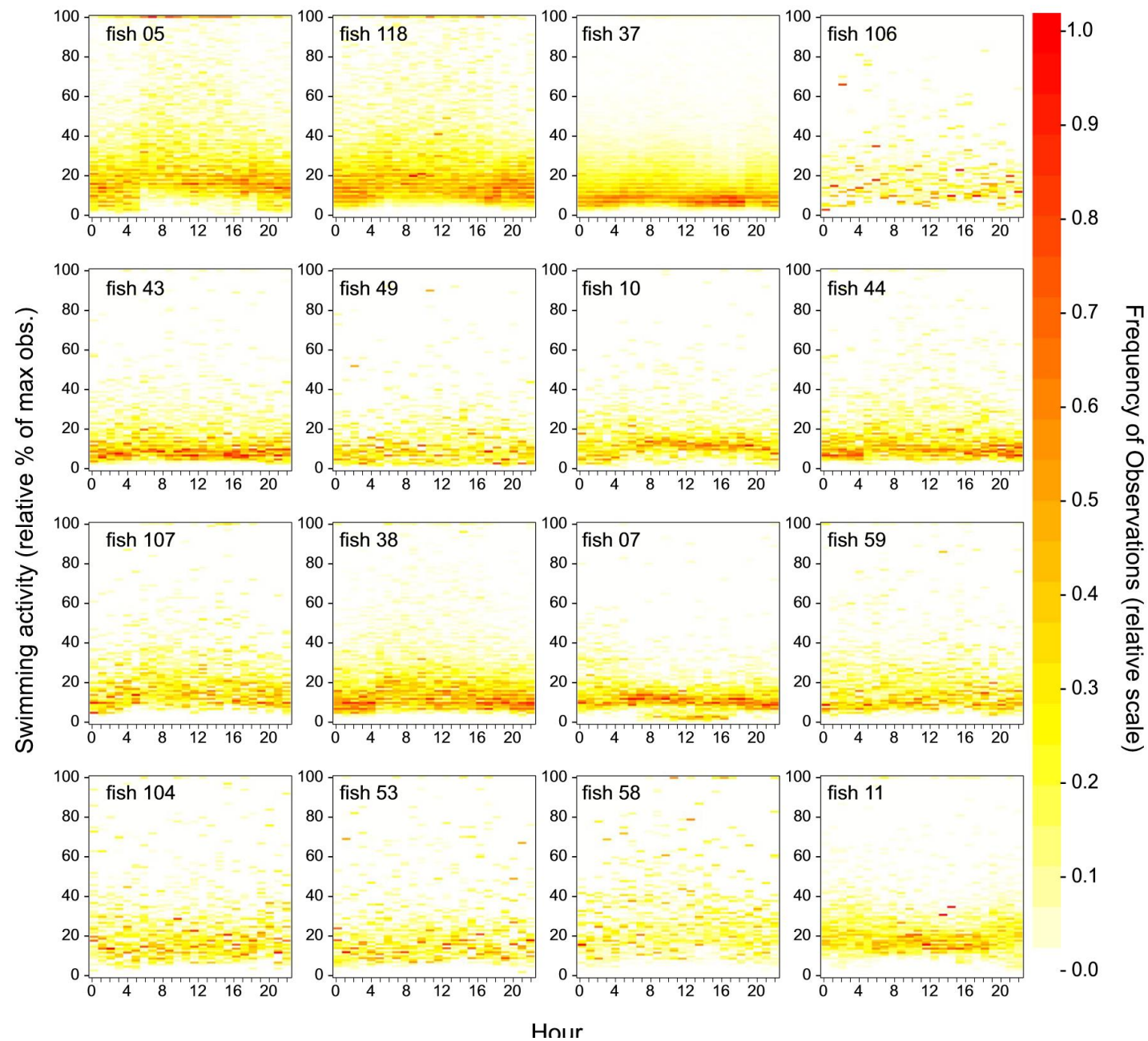


Results – depth use patterns post-release

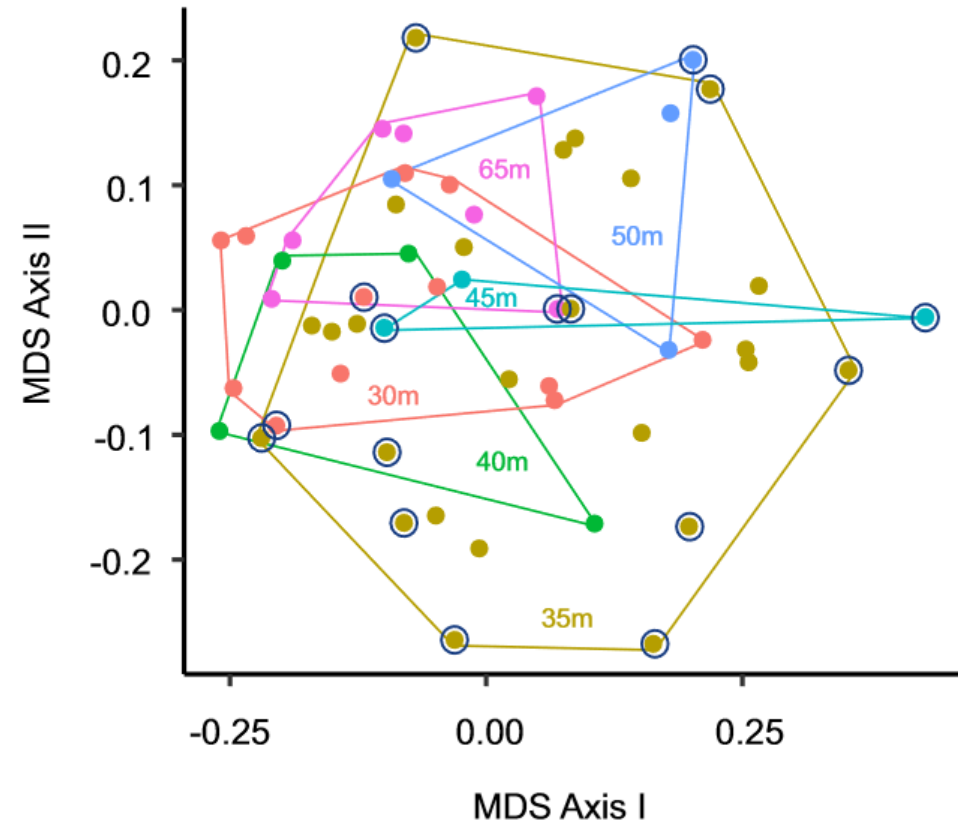
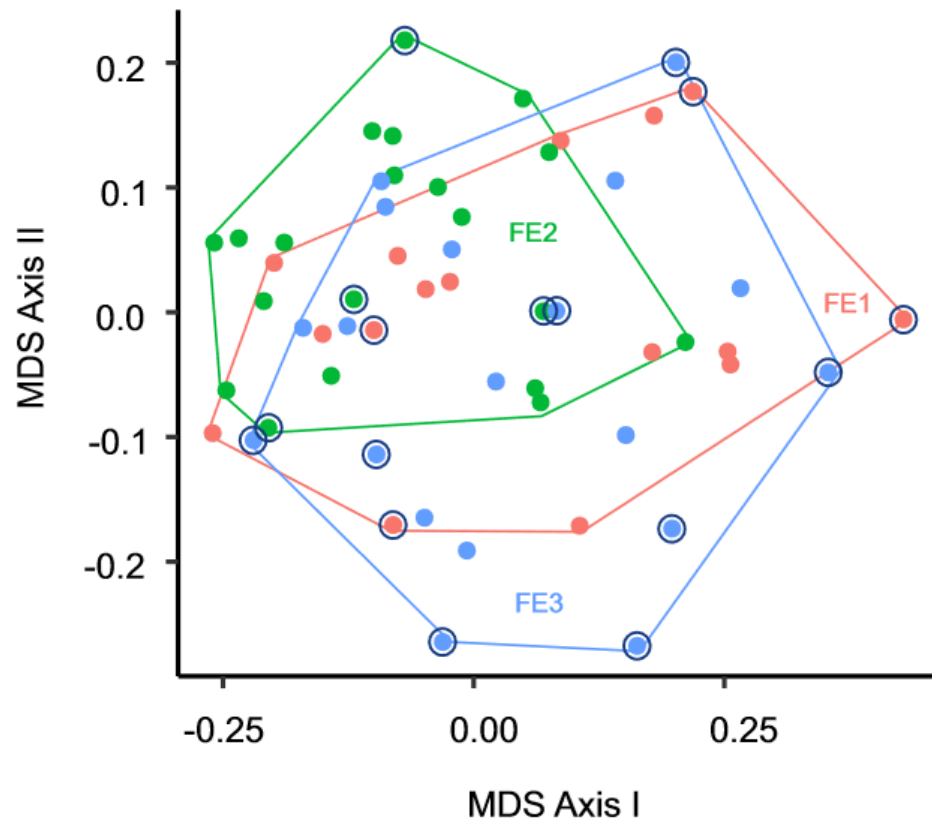


Sampling effort year and depth both predictors of depth use patterns

Results



Results



Sampling effort year - predictors of swimming activity use patterns

Post release impacts and recovery

Depth and swimming activity averaged and binned by hour

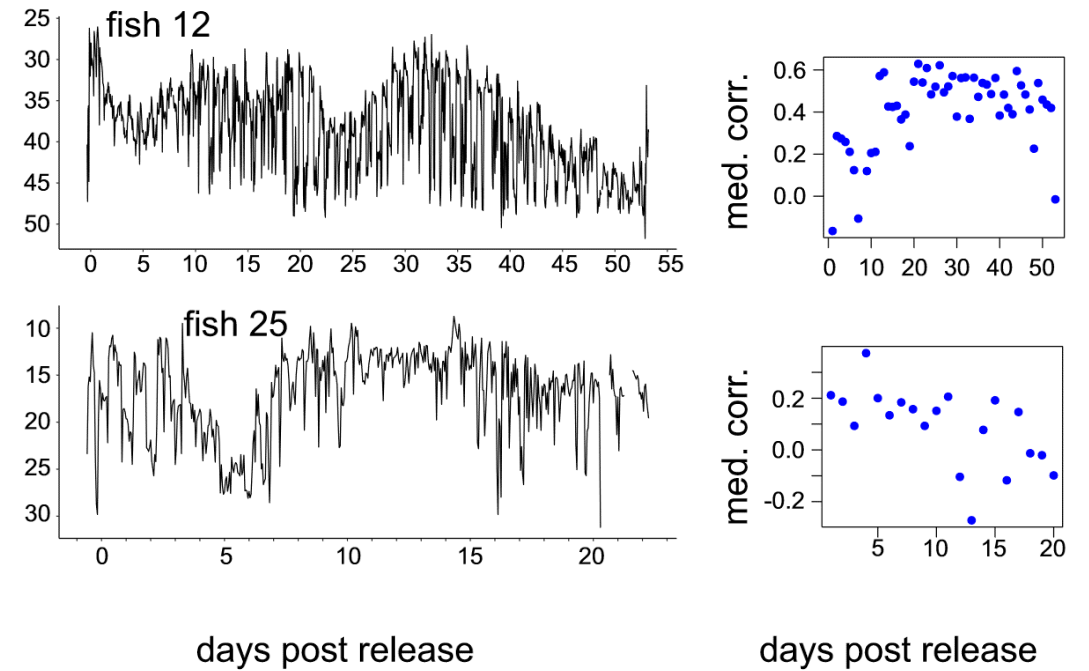
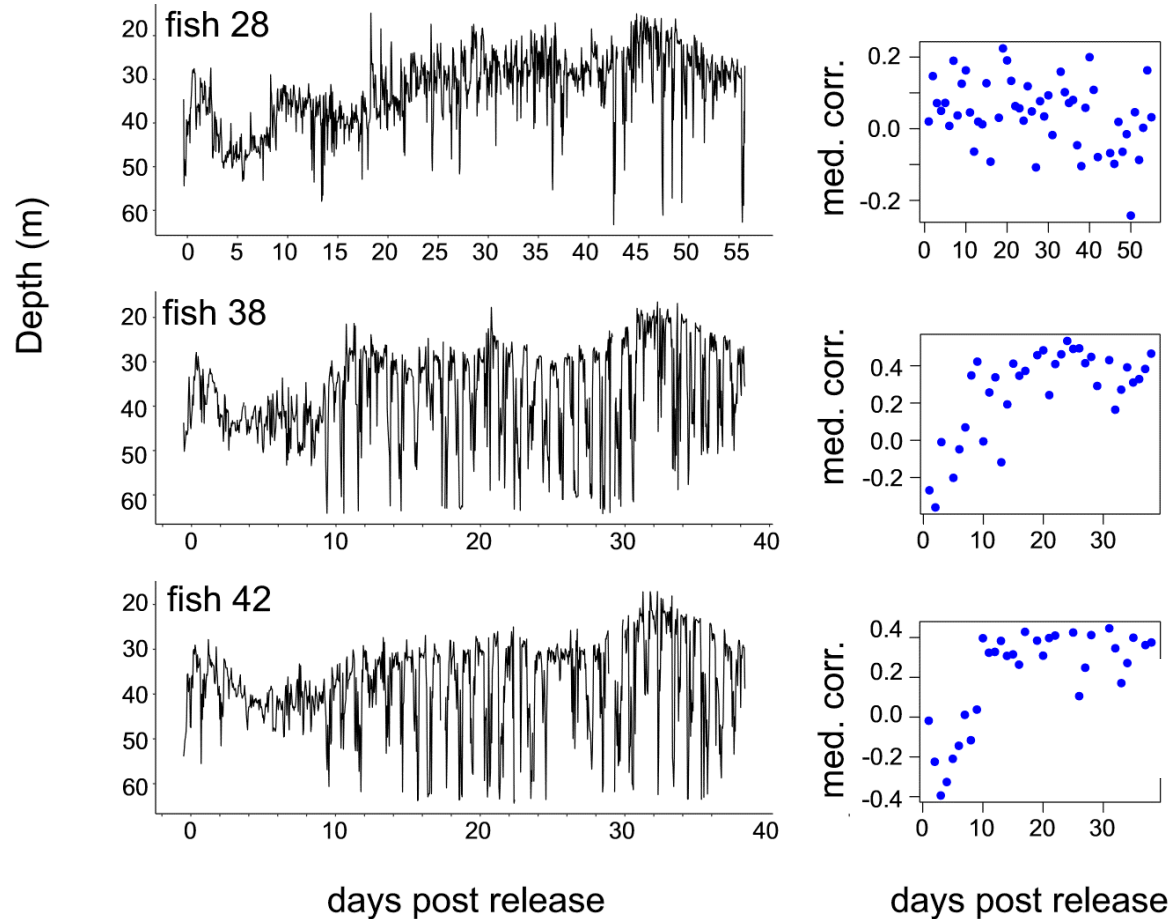
For fish with

- 1) complete data for diel periods on post-release 1-7**
- 2) at least 14 days of complete diel data**

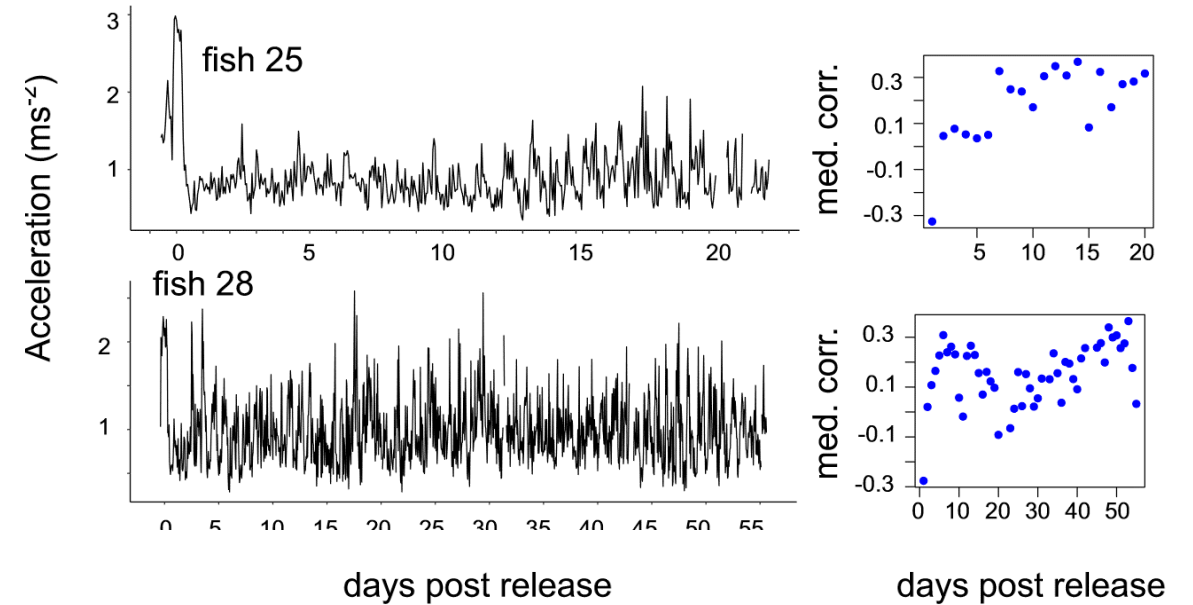
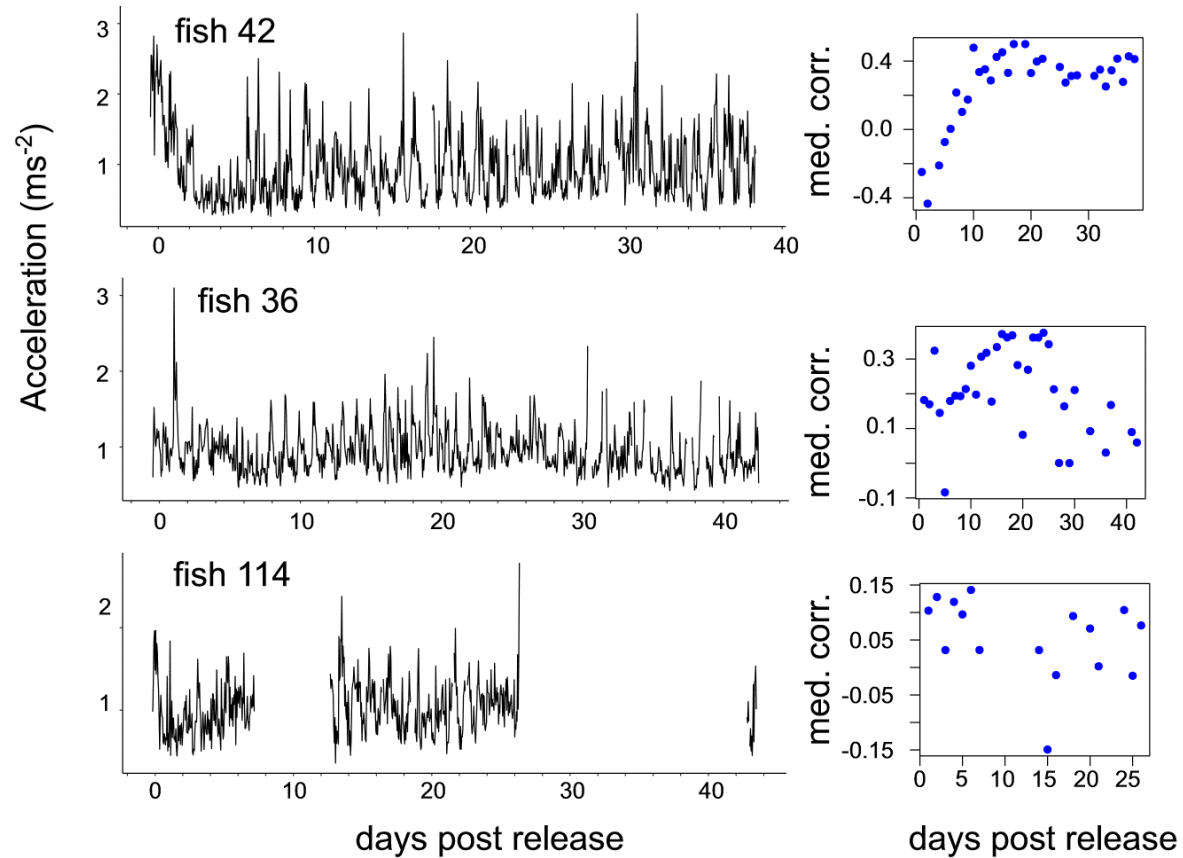
**Within each fish for depth and swimming activity,
calculate similarity of diel patterns (CCF)**

**Resampling procedure to determine if days 1-7 post-release differed from
the overall pattern**

Results – depth use following release



Results – swimming activity following release



Results

Swimming activity is altered for fish in the first five days of release

Fish show elevated tail beat activity for up to five days following release

Table 9 Mean and median ranks of daily similarity values of swimming activity profiles for the first 7 days post release of 23 fish

Fish	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Mean	15	24	35	31	29	56	51
Resampled <i>p</i>	< 0.001	0.002	0.002	< 0.001	< 0.001	> 0.05	> 0.05
Median	7	12	33	25	18	63	54
Resampled <i>p</i>	< 0.001	< 0.001	0.022	0.0014	< 0.001	> 0.05	> 0.05

Results – cyclonic storms during study period

8 fish emigrated during Hurricane Sally, 14 Sept 2020. 5 were detected on different reefs subsequently

Table 2 Summary of greater amberjack fish that were detected on two or more reefs throughout the acoustic telemetry period

Fish	Location #1, site tagged			Location #2				Location #3			
	Reef	Date tagged	Last detection	Reef	Date of 1 st detection at location #2	Distance to reef #1 (km)	Last detection at location #2	Reef	Date of 1 st detection at location #3	Distance to reef #2 (km)	Last detection
32	Py6	5/13/19	6/6/19	Bg	6/6/19	5.7	6/11/19	Py6 (returned)	6/11/19	5.7	6/25/19
35	Bt2	5/13/19	6/1/19	Py6	6/1/19	5.3	6/25/19				
48*	Py3	8/17/20	8/17/20	Py8	8/17/20	4.5	8/18/20				
49	Py3	8/17/20	8/17/20	Py8	8/18/20	4.5	9/14/20				
50*	Py8	8/17/20	8/18/20	Py3	8/18/20	4.5	8/18/20	Py8 (returned)	8/19/20	4.5	8/21/20
53	Bt3	8/18/20	9/14/20	Py6	9/23/20	6.5	9/23/20				
108	Py5	8/18/20	9/14/20	Bt3	9/23/20	6.4	10/1/20				
109	Py5	8/18/20	9/14/20	Bt3	9/18/20	6.4	9/20/20	Py5 (returned)	9/21/20	6.4	10/1/20
111	Py5	8/18/20	9/14/20	Hp & Su ¹	9/15/20	18.6	9/15/20				
114	Py5	8/18/20	9/14/20	Bt3	9/30/20	6.4	10/1/20				
115*	Py8	8/21/20	8/23/20	Py3	8/23/20	4.5	8/24/20	Py5	8/24/20	31.7	8/24/20
118	Hp	8/22/20	8/22/20	Hp & Su ²	8/22/20	0.5	8/22/20				
120	Hp	8/22/20	10/1/20	Hp & Su ²	8/22/20	0.5	10/1/20				
121*	Hp	8/22/20	8/22/20	Hp & Su ²	8/22/20	0.5	8/22/20				

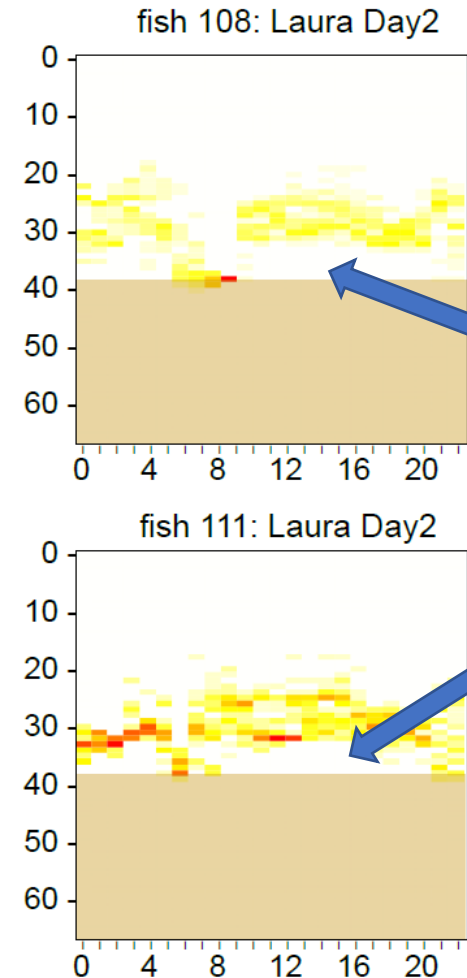
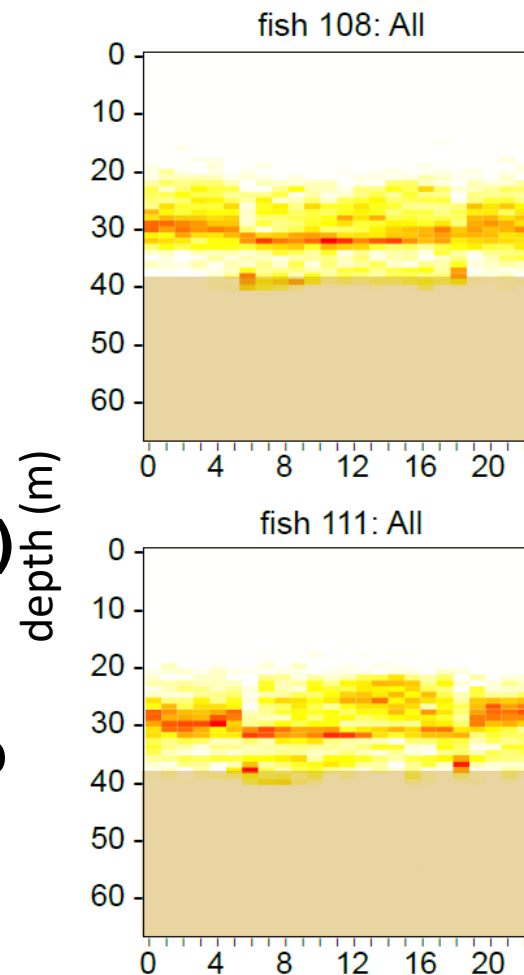
Results – cyclonic storms during study period

Resampling test

Depth profiles differed
from the overall diel
depth pattern

August 26, 2020,
Hurricane Laura (n = 4)

rank mean = 25.5, $p = 0.023$,
median = 16.0, $p = 0.012$)



Fish avoided
deeper depths
during Hurricane
Laura

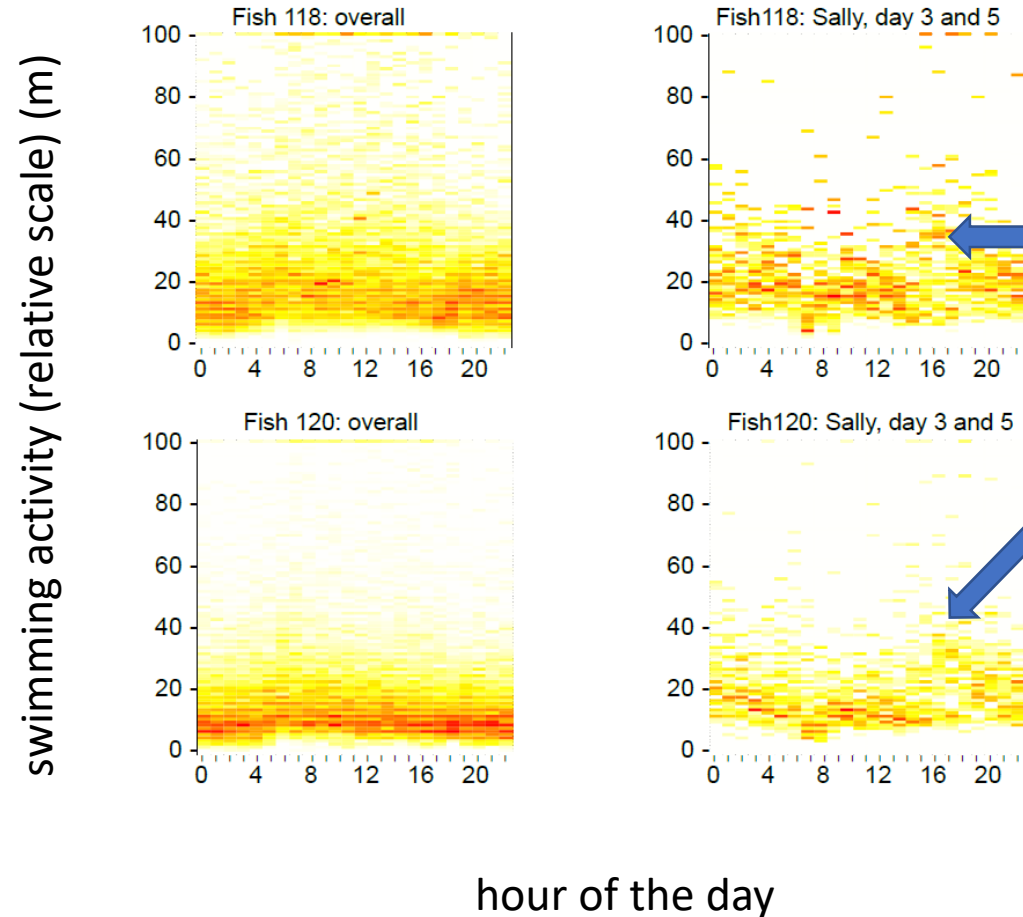
hour of the day

Results – cyclonic storms during study period

Resampling test

Swimming activity profiles differed from overall pattern September 14 & 16, 2020, Hurricane Sally (n = 2)

rank mean = 9.5,
p = 0.009,
median = 9.5,
p = 0.009)



Summary

Legal fish at higher risk of PRM

Barotrauma at sites < 65 m does not appear to increase PRM

Non-lethal impacts from surviving fish evident as elevated swimming activity for up to 5 days

impacts on growth, reproductive investment?

**Cyclonic storms associated with emigration from artificial reefs,
shallower depth associations, elevated swimming**

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