Utility and Usage of Descender Devices in the Red Snapper Recreational Fishery in the South Atlantic

SEDAR 73 WP 15

Julie Vecchio*, Dominique Lazarre, Beverly Sauls

FWC-FWRI

https://igfa.org/2020/06/16/descending-devices-required-in-south-atlantic-to-help-snapper-grouper/

What (if any) mortality reduction could be expected by the increased use of descending devices in the South Atlantic Red Snapper fishery?

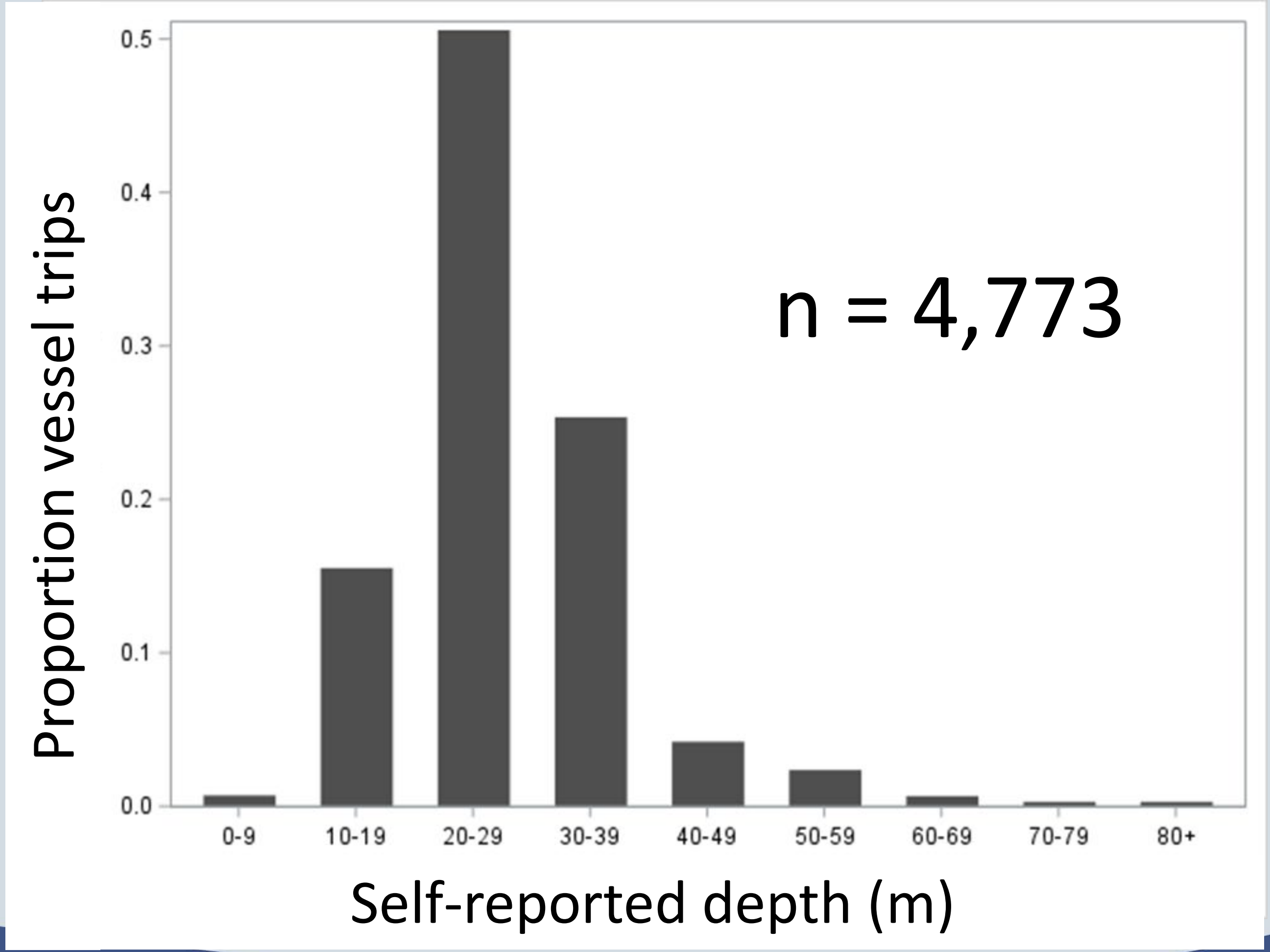
https://www.facebook.com/pg/Northern-red-snapper-1661059944137568/posts/

Red Snapper Private Boat fishing

Dockside interviews during South Atlantic Red Snapper open season 2013-2020

Reported targeting or harvesting Red Snapper

Majority fishing depth (converted to meters)

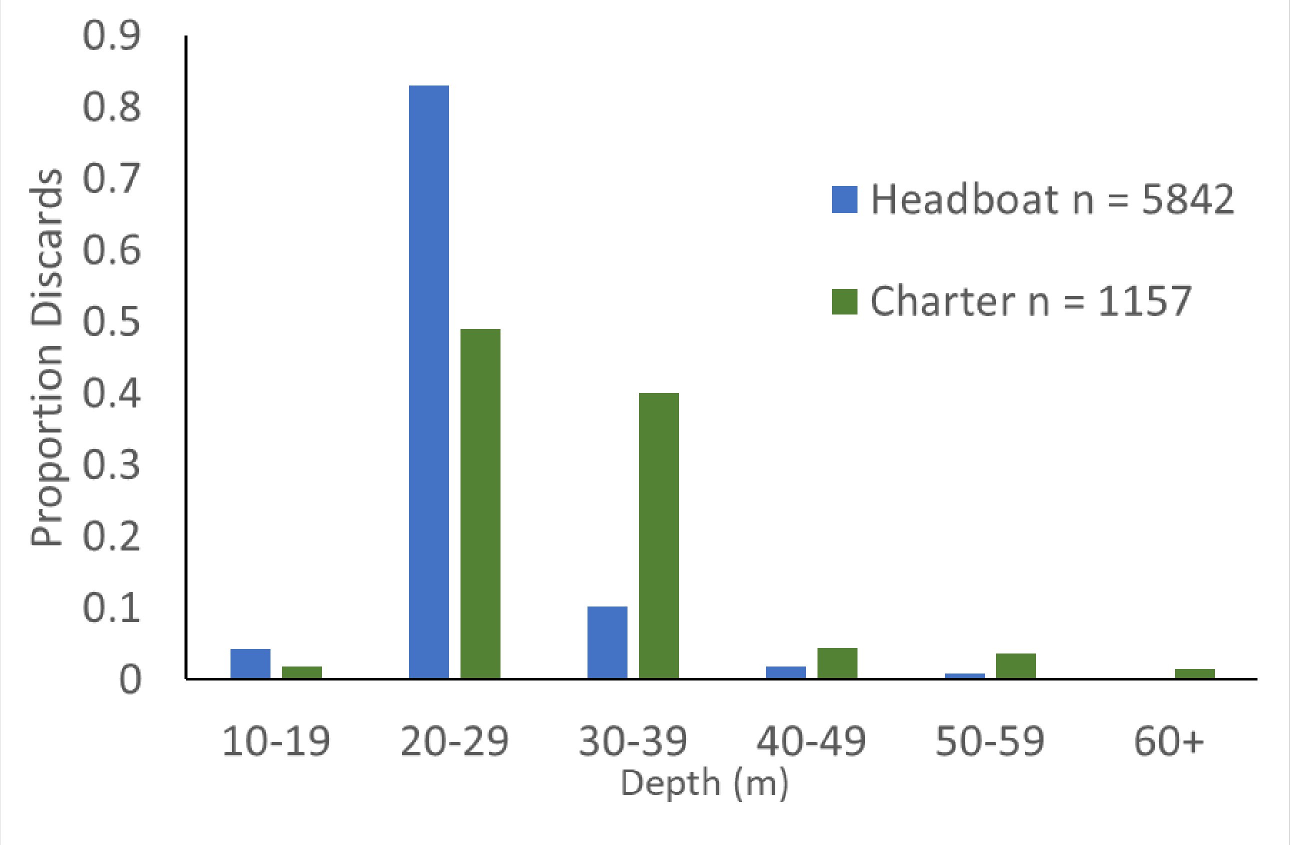


At-sea observations:
Fishing depth for caught & released Red Snapper

Ongoing, year-round data collection

At-sea observers ride along on for-hire fishing tips

Record location, depth, species, size, disposition & release condition



At-sea observations:
Released Red Snapper condition codes

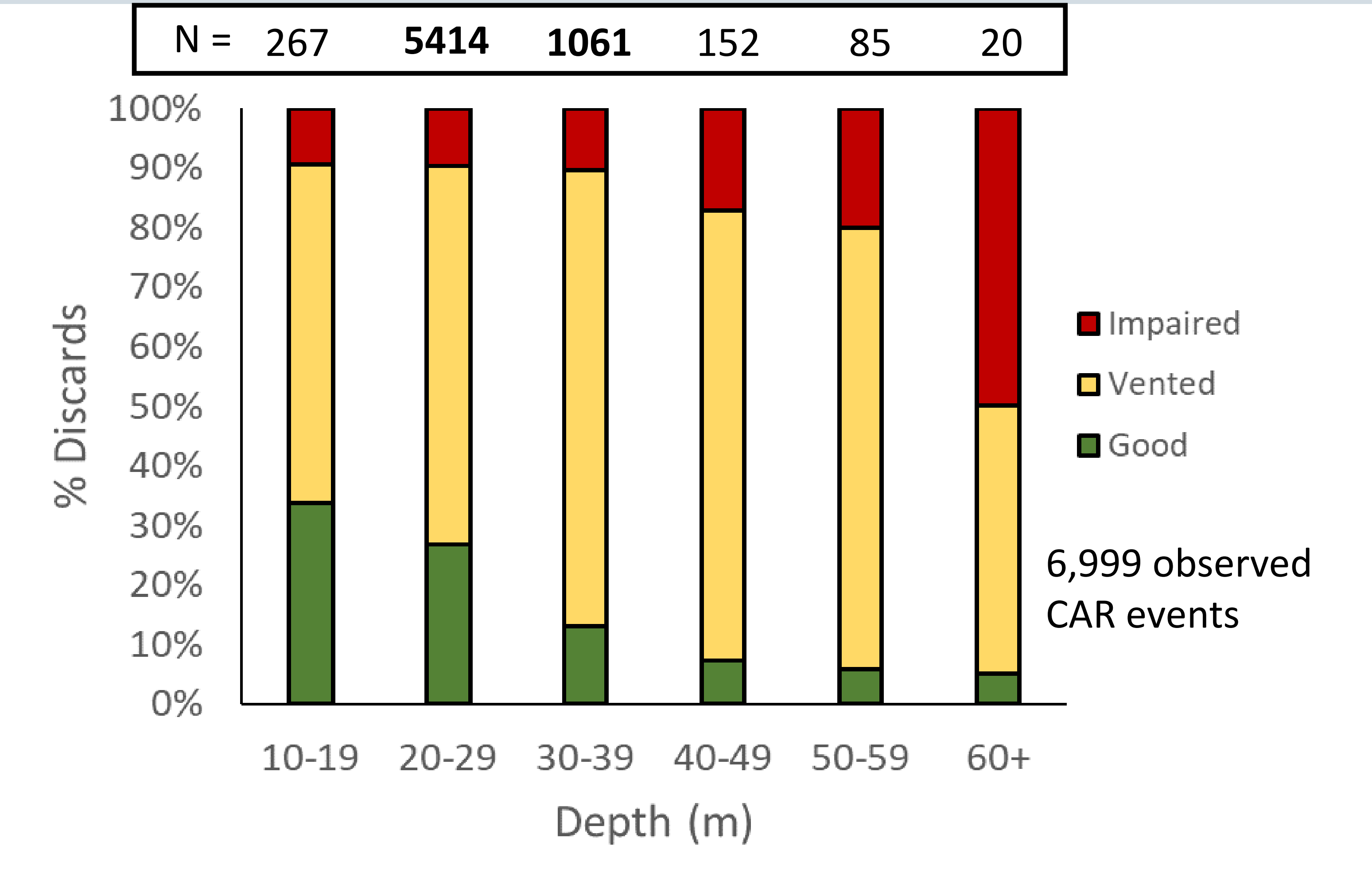
Condition category	Description
Good (not impaired and not vented)	Fish immediately submerged without the assistance of venting, and did not exhibit any impairments
Vented (not impaired and vented)	Fish immediately submerged after the swim bladder was vented, and did not exhibit any impairments
Impaired	Any fish that exhibited one or more of the following impairments: 1) chased by a predator near the surface 2) disoriented or unresponsive at the surface before submerging 3) buoyant at the surface and unable to submerge 4) improperly vented by puncturing the stomach or anus 5) hook embedded in gill, eye, esophagus, or gut 6) released with hook still embedded 7) bleeding from the gills 8) exopthalmia, indicative of severe barotrauma

At-sea observations:
Released Red Snapper condition observations

Good: No intervention, swam down strongly

Vented: Vented, swam down strongly

Impaired: Problems swimming down, improper venting, deep-hooked



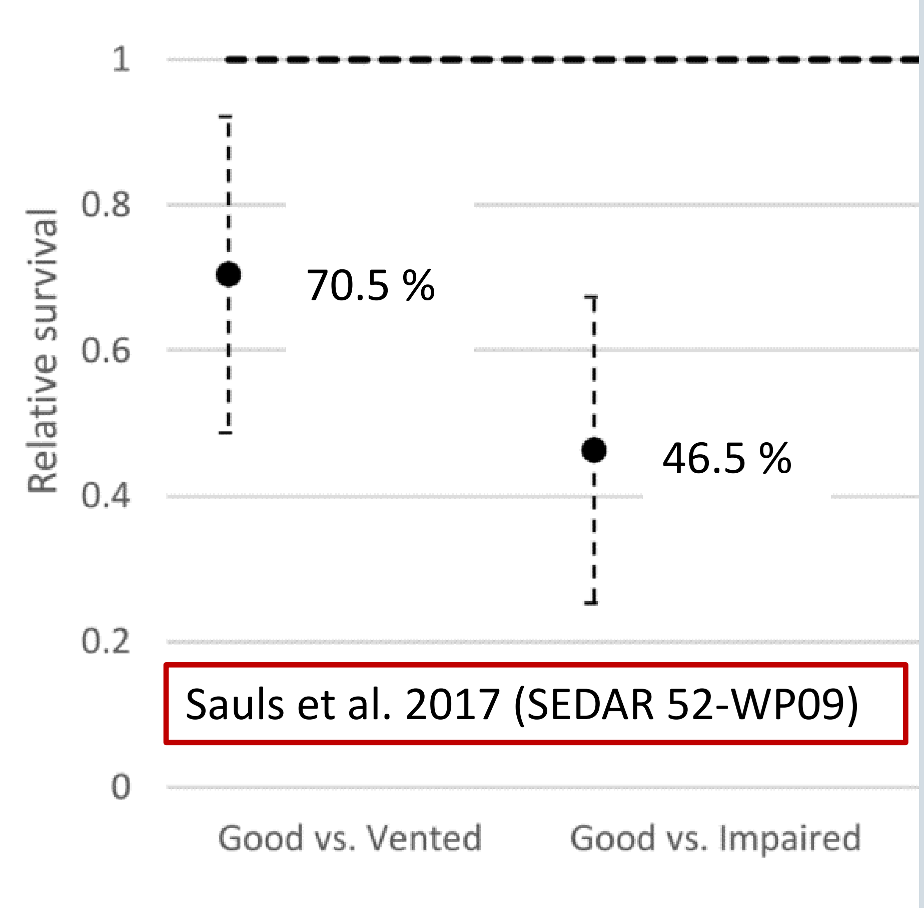
Estimating Release Survival

Over 6,000 discarded fish tagged

Proportional hazards model:

Likelihood of recapture

First presented in SEDAR 52-WP09



Estimating mortality

(method used in SEDAR 52 WP-09)

$$M_d = \frac{1 - \left(N_1 S_1 + N_2 \hat{H}_2 + N_3 \hat{H}_3\right)}{N_1 + N_2 + N_3}$$

N = # fish observed in category (Good/Vent/Impaired)

S = Survival proportion of fish coded "Good"

H = Survival of fish coded "Vent" or "Impaired"

Estimating mortality

(method used in SEDAR 52 WP-09)

$$M_d = \frac{1 - \left(\boxed{N_1 S_1} + N_2 \widehat{H}_2 + N_3 \widehat{H}_3\right)}{N_1 + N_2 + N_3}$$

Estimating mortality

(method used in SEDAR 52 WP-09)

$$M_d = \frac{1 - \left(N_1 S_1 \boxed{+ N_2 \widehat{H}_2} + N_3 \widehat{H}_3\right)}{N_1 + N_2 + N_3}$$

+

Estimating mortality

(method used in SEDAR 52 WP-09)

$$M_d = \frac{1 - \left(N_1 S_1 + N_2 \widehat{H}_2 \boxed{+ N_3 \widehat{H}_3}\right)}{N_1 + N_2 + N_3}$$

+

+

What happens when some anglers descend released fish?

Descending Devices Required for All Boats Fishing for Snapper and Grouper in South Atlantic Federal Waters: Effective July 15, 2020

JUNE 16, 2020 BY INTHEBITE EDITOR

Literature Estimates of Difference in Release Survival between descended, vented, impaired

Study	D-V (%)	D-N (%)
Curtis et al 2015	5	22
Ayala 2020	5.82	--
Bohaboy et al 2020	--	20
Mean	**+5.41**	**+21.00**

Estimating mortality
(including variable proportion descended)

$$M_d = \frac{1 - \left(N_1 S_1 + \boxed{N_2 \widehat{D}_1 X_1} + N_2 \widehat{H}_2 (1 - X_1) + \boxed{N_3 \widehat{D}_2 X_1} + N_3 \widehat{H}_3 (1 - X_1)\right)}{N_1 + N_2 + N_3}$$

N = # fish observed in category (Good/Vent/Impaired)

S = Survival of fish coded "Good"

H = Survival of fish coded "Vent" or "Impaired"

D = Survival of fish coded "Descend"

X = Proportion moved from Vent or Impaired to Descend (0, 25, 50, 75, 100%)

Estimating mortality
(including varying proportion descended)

$$M_d = \frac{1 - \left(N_1 S_1 + N_2 \boxed{\widehat{D}_1} X_1 + N_2 \widehat{H}_2 (1 - X_1) + N_3 \widehat{D}_2 X_1 + N_3 \widehat{H}_3 (1 - X_1)\right)}{N_1 + N_2 + N_3}$$

+5.4%

Estimating mortality
(including varying proportion descended)

$$M_d = \frac{1 - \left(N_1 S_1 + N_2 \boxed{\widehat{D}_1} X_1 + N_2 \widehat{H}_2 (1 - X_1) + N_3 \boxed{\widehat{D}_2} X_1 + N_3 \widehat{H}_3 (1 - X_1)\right)}{N_1 + N_2 + N_3}$$

+5.4%

+21.0%

Estimating mortality
(including variable proportion descended)

$$M_d = \frac{1 - \left(N_1 S_1 + \boxed{N_2 \widehat{D}_1 X_1} + N_2 \widehat{H}_2 (1 - X_1) + \boxed{N_3 \widehat{D}_2 X_1} + N_3 \widehat{H}_3 (1 - X_1)\right)}{N_1 + N_2 + N_3}$$

Estimating mortality

(including variable proportion descended)

$$M_d = \frac{1 - \left(N_1 S_1 + \boxed{N_2 \widehat{D}_1 X_1} + N_2 \widehat{H}_2 (1 - X_1) + \boxed{N_3 \widehat{D}_2 X_1} + N_3 \widehat{H}_3 (1 - X_1)\right)}{N_1 + N_2 + N_3}$$

Estimating mortality
(including variable proportion descended)

$$M_d = \frac{1 - \left(N_1 S_1 + \boxed{N_2 \widehat{D}_1 X_1} + N_2 \widehat{H}_2 (1 - X_1) + \boxed{N_3 \widehat{D}_2 X_1} + N_3 \widehat{H}_3 (1 - X_1)\right)}{N_1 + N_2 + N_3}$$

Estimating mortality
(including variable proportion descended)

$$M_d = \frac{1 - \left(N_1 S_1 + \boxed{N_2 \widehat{D}_1 X_1} + N_2 \widehat{H}_2 (1 - X_1) + \boxed{N_3 \widehat{D}_2 X_1} + N_3 \widehat{H}_3 (1 - X_1) \right)}{N_1 + N_2 + N_3}$$

Estimating mortality
(including varying proportion descended)

$$M_d = \frac{1 - \left(N_1 S_1 + N_2 \widehat{D}_1 X_1 + N_2 \widehat{H}_2 (1 - X_1) + N_3 \widehat{D}_2 X_1 + N_3 \widehat{H}_3 (1 - X_1)\right)}{N_1 + N_2 + N_3}$$

Depth-dependent release mortality

Proportional survival by release condition

+

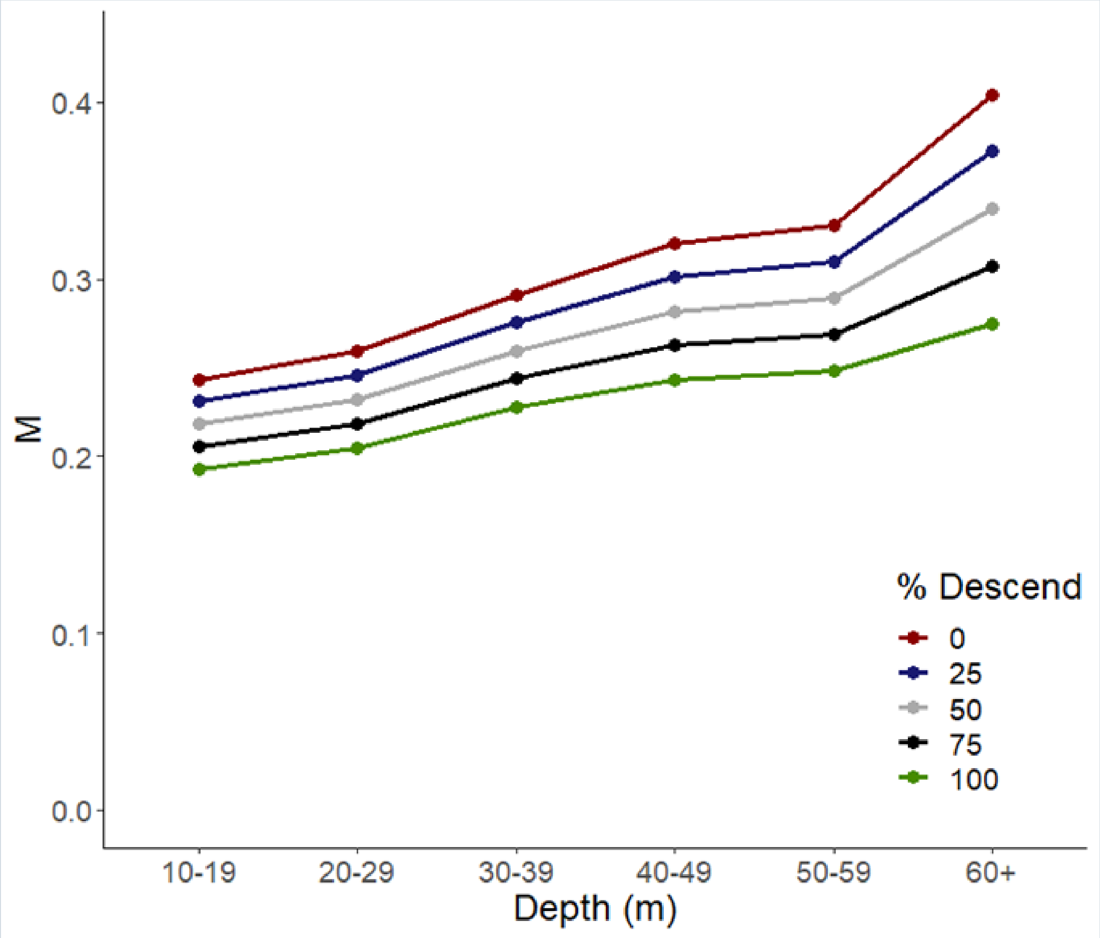
Proportional treatment by depth

+

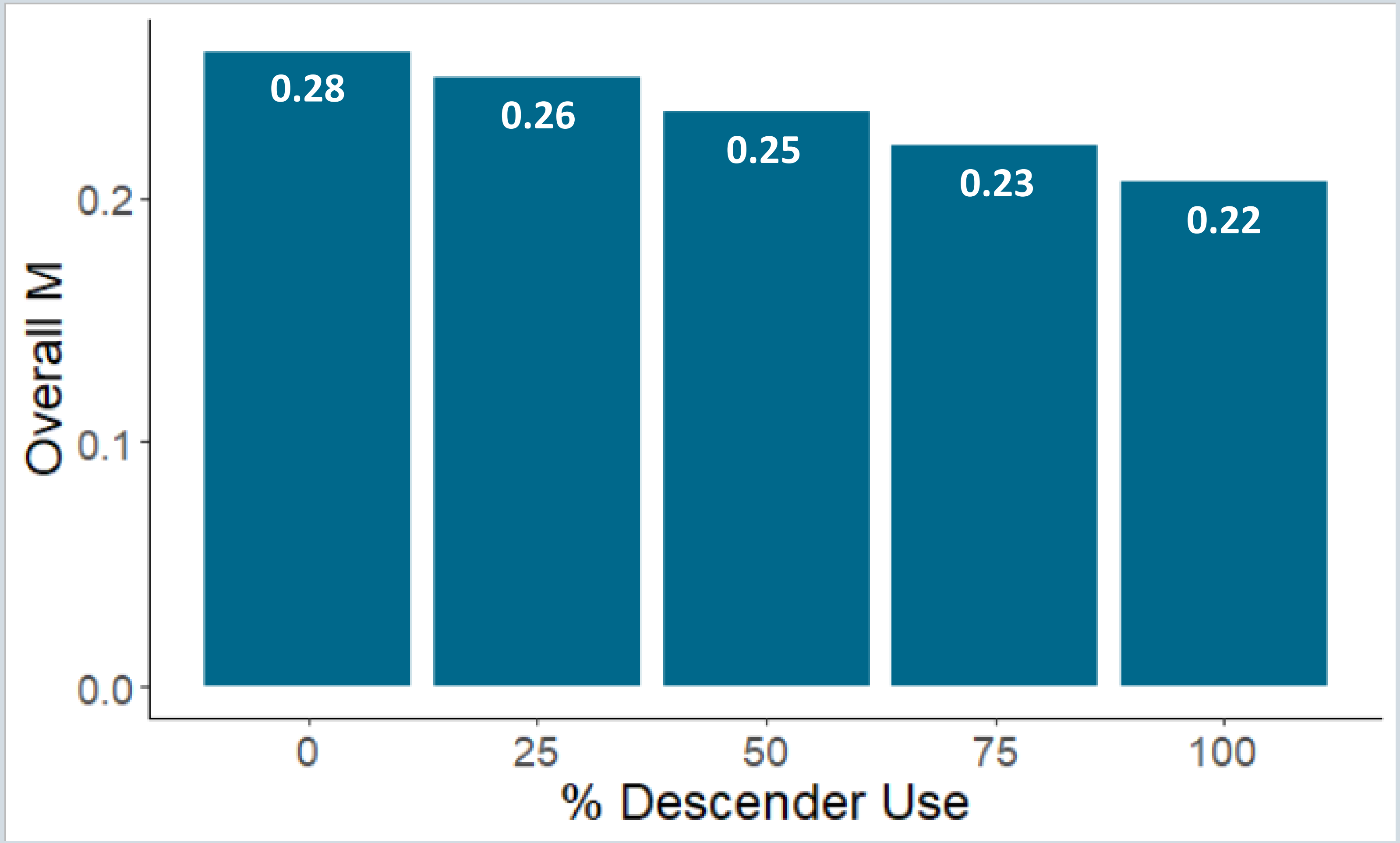
Proportional descender usage (0-100%)

=

Proportional survival by depth



Total discard mortality: Charter fishery *(proxy for private)*



Proportions of Anglers Using Descenders

FL Red Snapper season dockside interviews 2018-2019

801 anglers reported releasing Red Snapper that day

Surface Release	**33%**
Vented	**65%**
Descended	**1.5%**

GA anglers participating in carcass drop-off program 2018-2019

41 completed catch cards

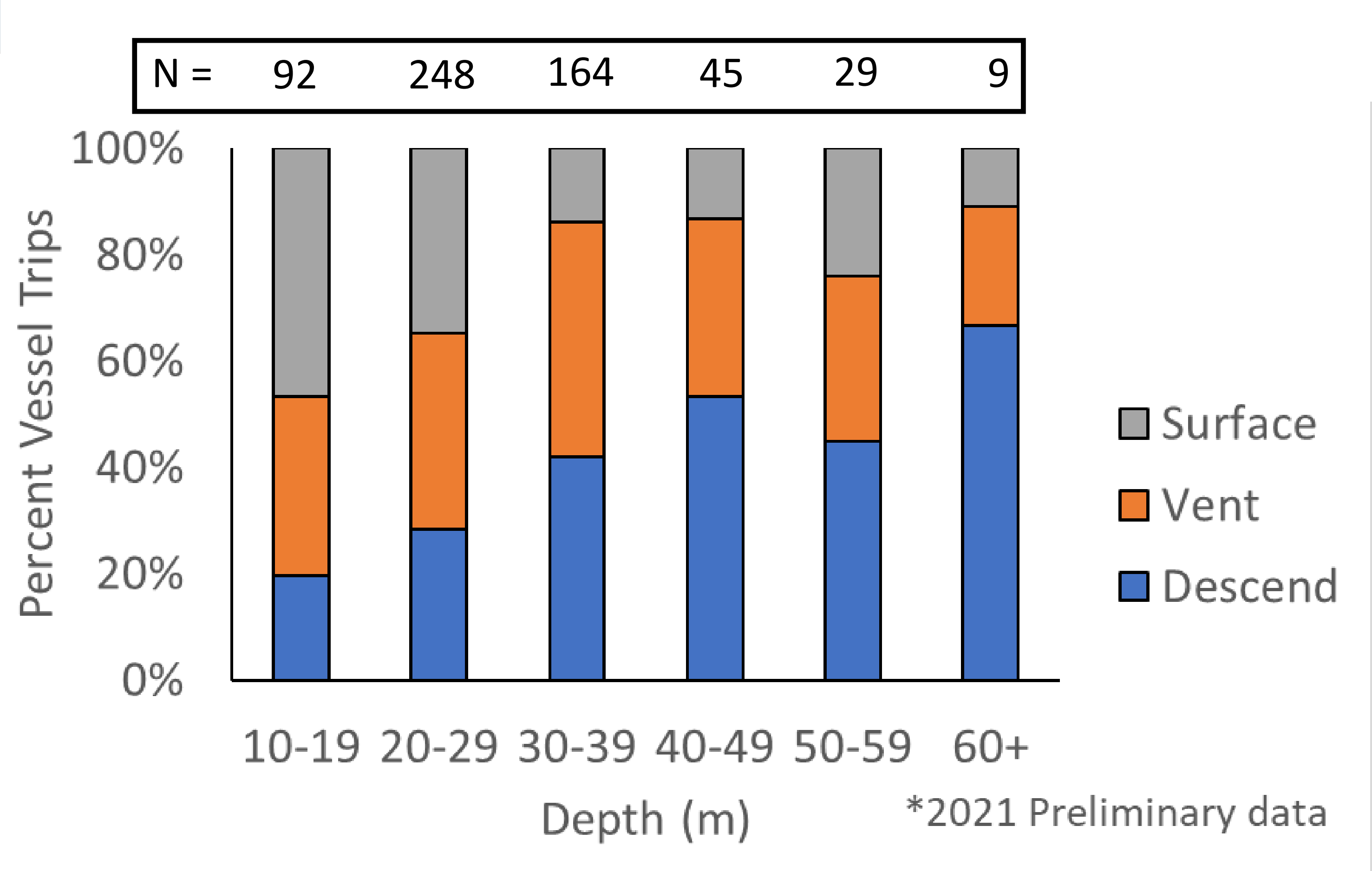
35 released fish

Surface Release	**34%**
Vented	**3%**
Descended	**63%**

* PRELIMINARY 2021 data

587 angler trips reported releasing Red Snapper

Surface Release	**28%**
Vented	**37%**
Descended	**34%**



SEDAR 73 Report Decision

Based on the above information and extensive discussion, SEDAR 73 panel decided to include 4 time-blocks in the model of discard mortality

	→ 2006 or 2010	B1 →2017	2017-2020	2021 →
Fleet	Block 1	Block 2	Block 3	Block 4
cH	0.48(0.38 – 0.58)	0.38(0.28 – 0.48)	0.36(0.26 – 0.46)	0.32(0.22 – 0.42)
HB	0.37(0.27 – 0.45)	0.26(0.18 – 0.34)	0.25(0.17 – 0.33)	0.22(0.14 – 0.30)
GR	0.37(0.27 – 0.45)	0.28(0.20 – 0.36)	0.26(0.18 – 0.34)	0.23(0.15 – 0.31)
	J-hook	Circle-hook	25% descend	75% descend

SEDAR 73 WP 15

Julie Vecchio*, Dominique Lazarre, Beverly Sauls

FWC-FWRI

Julie.Vecchio@myfwc.com

Thank you!

Alternate Calculation Method

Vecchio et al. (in prep) 2021

Estimating descender mortality

Study	Depth (m)	n	n survived	% survival
Bohaboy et al (2020)	30	30	22	73.33
Curtis et al (2015)	30-50	25	20	80.00
Drumhiller et al (2014)	30	6	6	100.00
Runde et al (2021)	37	36	33	91.67
Stunz et al (2017)	40	15	14	93.33
Tompkins (2017)	30-50	40	30	75.00
Average (± SD)	**30-50**	**97**	**83**	**82.26 ± 10.93**

At-sea observations – charter boats and headboats

Condition category	Description
Good (not vented/not impaired)	Fish immediately submerged without the assistance or venting, and did not exhibit any impairments
Vented (not impaired)	Fish immediately submerged after the swim bladder was vented, and did not exhibit any impairments
Impaired (vented or unvented: displaying distress)	Any fish that exhibited one or more of the following impairments: 1) chased by a predator near the surface 2) disoriented or unresponsive at the surface before submerging 3) buoyant at the surface and unable to submerge 4) improperly vented by puncturing the stomach or anus 5) bleeding from the gills 6) exophthalmia (pop-eye), indicative of severe barotrauma
Deep Hooked (hook embedded in deep tissue)	Any fish for which either of the following was true: 1) hook embedded in gill, eye, esophagus, or gut 2) released with hook still embedded

Modeling mortality by depth
(including different proportion descended)

$$M_d = \frac{1 - \left(N_1 S_1 + N_2 X_1 \widehat{D}_2 + N_2 \widehat{H}_2 (1 - X_1) + N_3 X_1 \widehat{D}_2 + N_3 \widehat{H}_3 (1 - X_1) + N_4 \widehat{H}_3\right)}{N_1 + N_2 + N_3 + N_4}$$

N = # fish observed in category (Good/Vent/Impaired)

S = Survival of fish coded "Good" (0.925)

H = Survival of fish coded "Vent", "Impaired", "Deep-hooked" (0.705, 0.465, 0.465)

D = Survival of fish coded "Descend" (0.823)

X = Proportion moved from Vent or Impaired to Descend (0, 0.25, 0.50, 0.75, 1.0)

Depth-dependent release mortality

Proportional survival by treatment

+

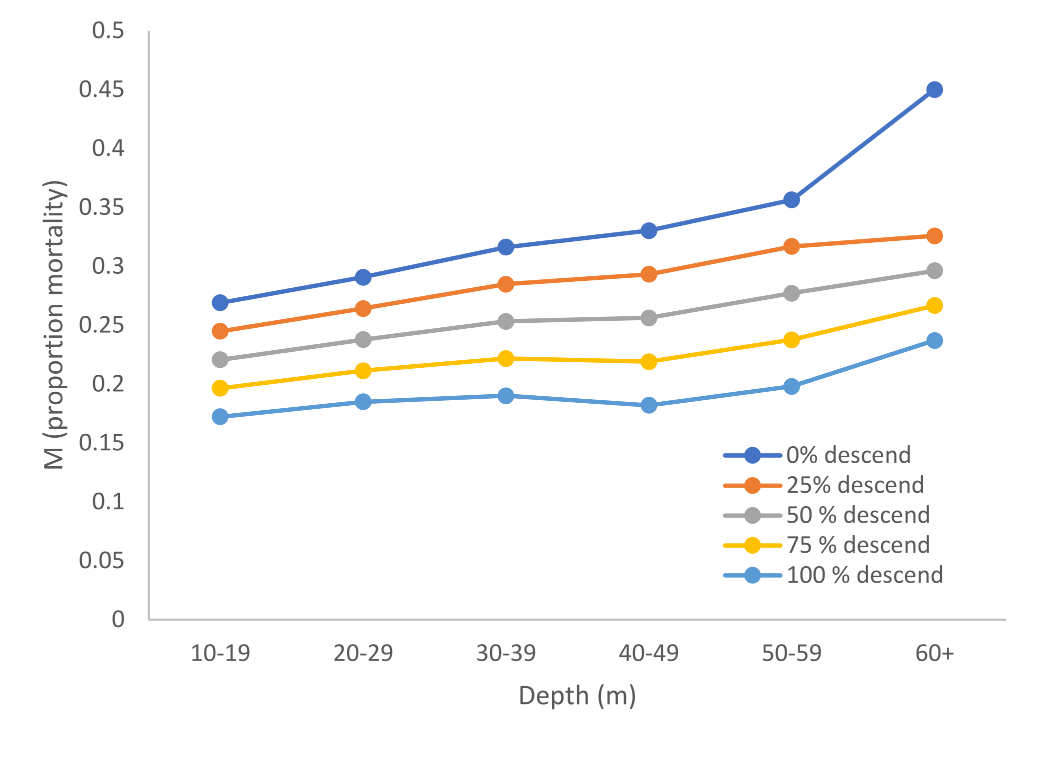
Proportional treatment by depth

+

Proportional descender usage

=

Proportional survival by depth



Total discard mortality: Charter fishery *(proxy for private)*