The potential for resource impacts from long-term fishery monitoring surveys

John Harms[1], Chantel Wetzel[1], John Wallace[1], Jim Benante[2], Aaron Chappell[1], Laurel Lam[2]

[1]NOAA Fisheries
Northwest Fisheries Science Center
Seattle, WA

[2]Pacific States Marine Fisheries Commission
Northwest Fisheries Science Center
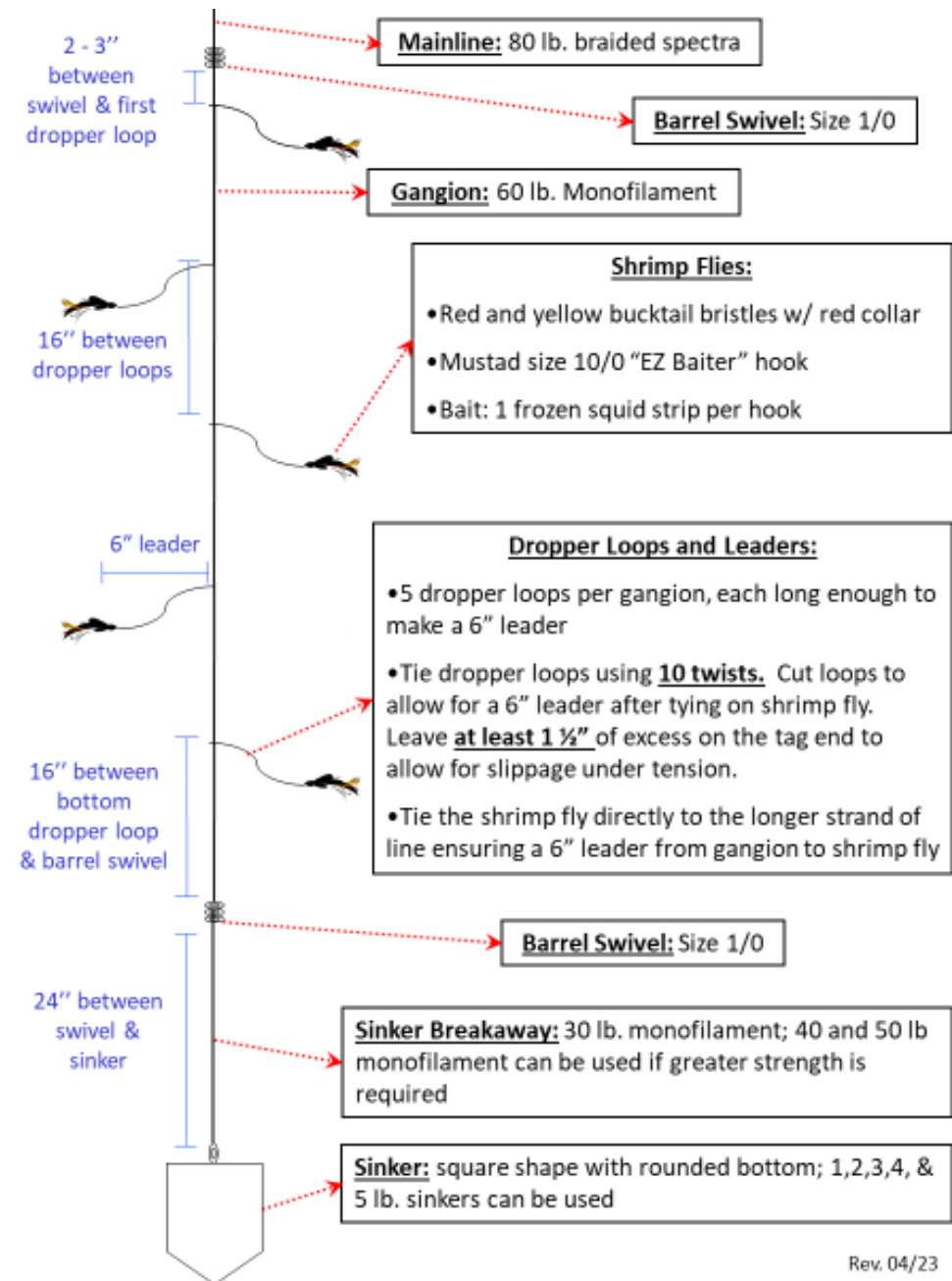Seattle, WA

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Outline

- Survey background and sampling methods

- Impact metrics and temporal scales

- Results

- Synthesis and future research

Survey background and methods

- Fishery-independent survey to generate abundance and biological data for structure-associated groundfish for use in assessments

- Conducted annually since 2004

- Southern CA: Pt Conception to Mexican border

- 20 – 125 fathoms

- 201 fixed sites

- 3 chartered sportfishing vessels operating simultaneously

- Gear deployed by rod and reel

- 75 total hooks per site:
 - 3 anglers
  - 5 coordinated drops
  - 5 hook sampling rig

2 - 3" between swivel & first dropper loop

16" between dropper loops

6" leader

16" between bottom dropper loop & barrel swivel

24" between swivel & sinker

Mainline: 80 lb. braided spectra

Barrel Swivel: Size 1/0

Gangion: 60 lb. Monofilament

Shrimp Flies:
- Red and yellow bucktail bristles w/ red collar
- Mustad size 10/0 "EZ Baiter" hook
- Bait: 1 frozen squid strip per hook

Dropper Loops and Leaders:
- 5 dropper loops per gangion, each long enough to make a 6" leader
- Tie dropper loops using **10 twists.** Cut loops to allow for a 6" leader after tying on shrimp fly. Leave **at least 1 ½"** of excess on the tag end to allow for slippage under tension.
- Tie the shrimp fly directly to the longer strand of line ensuring a 6" leader from gangion to shrimp fly

Barrel Swivel: Size 1/0

Sinker Breakaway: 30 lb. monofilament; 40 and 50 lb monofilament can be used if greater strength is required

Sinker: square shape with rounded bottom; 1,2,3,4, & 5 lb. sinkers can be used

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Survey sites

Current sampling frame: 201 fixed sites

121 sites outside of CCAs (red dots)

Added 79 sites inside the two CCAs starting in 2014 (yellow dots)

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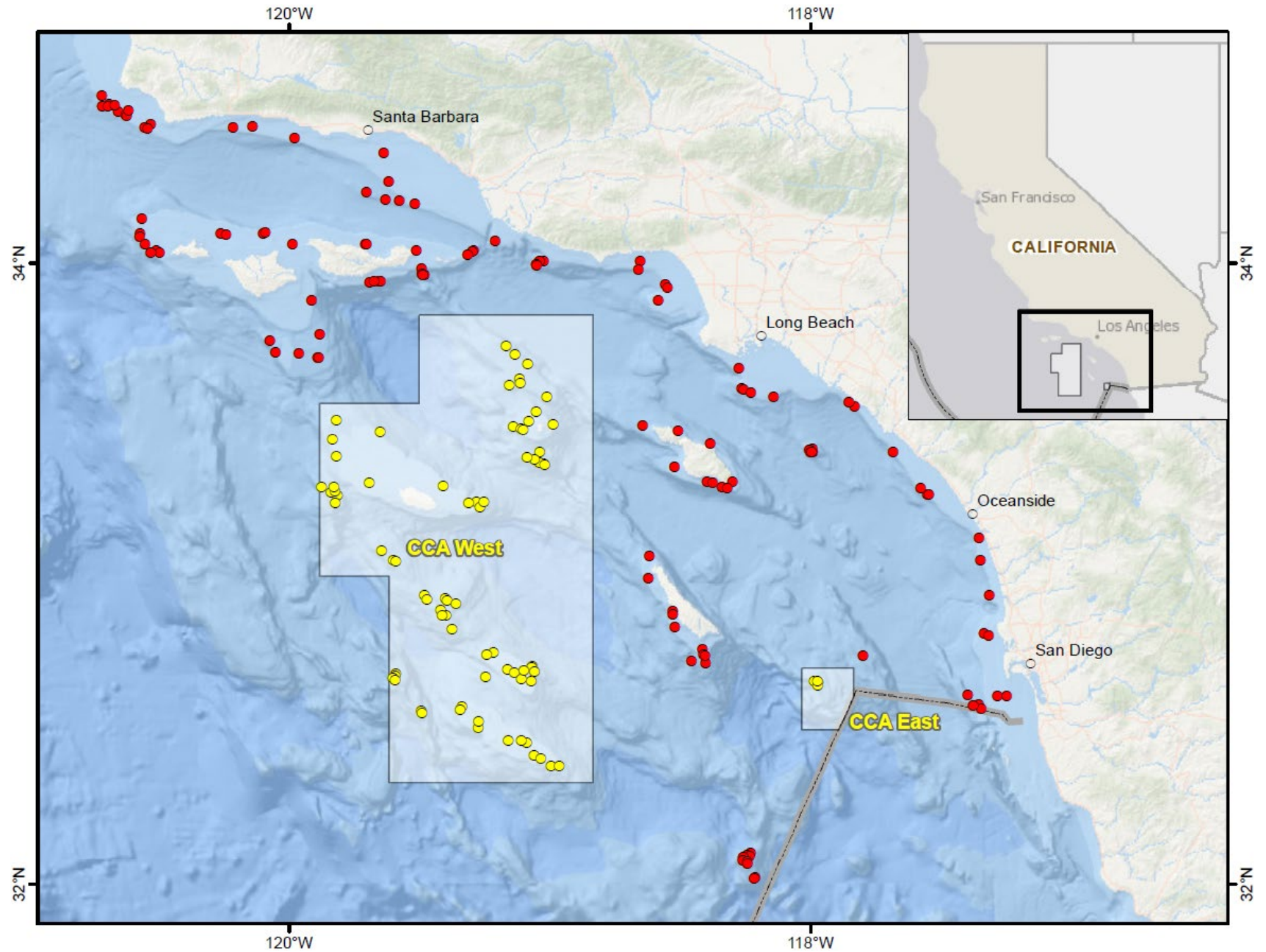
Impact metrics and model type

1. Probability of a hook catching any species → Binomial GLM

2. Probability of a hook catching a target species[1] → Binomial GLM

3. Probability of a hook catching a non-target species[2] → Binomial GLM

4. Probability of a hook catching a bocaccio → Binomial GLM

5. Probability of a hook catching a vermilion/sunset rockfish → Binomial GLM

6. Species richness (count of unique species) → Poisson GLM

7. Bocaccio length → Gaussian GLM

8. Vermilion/sunset rockfish length → Gaussian GLM

Temporal scales

1. **Short** (1-2 hr): from drop 1 to drop 5 during normal survey sampling

2. **Medium** (48-96 hr): n = 29 instances of experimental re-sampling of a site following normal survey sampling and a "rest" interval of 2-4 days

3. **Long** (1-5 yr): comparing survey catch data from sampling visits when a site was skipped the previous year (for example, due to weather or Navy closures) vs. visits when it was sampled the previous year

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[1]**Target species**: Bank Rockfish, Barred Sand Bass, Blackgill Rockfish, Blue Rockfish, Bocaccio Rockfish, Bronzespotted Rockfish, Brown Rockfish, California Scorpionfish, California Sheephead, California Yellowtail, Canary Rockfish, Chilipepper Rockfish, Copper Rockfish, Cowcod Rockfish, Flag Rockfish, Gopher Rockfish, Greenblotched Rockfish, Greenspotted Rockfish, Lingcod, Mexican Rockfish, Ocean Whitefish, Olive Rockfish, Pacific Bonito, Pink Rockfish, Sablefish, Silvergray Rockfish, Speckled Rockfish, Starry Rockfish, Treefish, Vermilion Rockfish, Widow Rockfish, Yelloweye Rockfish, Yellowtail Rockfish

[2]**Non-target species**: Brown Smoothound, Calico Rockfish, Freckled Rockfish, Gray Smoothound, Greenstriped Rockfish, Halfbanded Rockfish, Honeycomb Rockfish, Lizardfish, Pacific Jack Mackerel, Pacific Mackerel, Pacific Sanddab, Pacific Spiny Dogfish, Petrale Sole, Pinkrose Rockfish, Rosethorn Rockfish, Rosy Rockfish, Sharpchin Rockfish, Shortbelly Rockfish, Southern Rock Sole, Squarespot Rockfish, Stripetail Rockfish, Swordspine Rockfish, White Croaker, Whitespeckled Rockfish, and all invertebrate species.
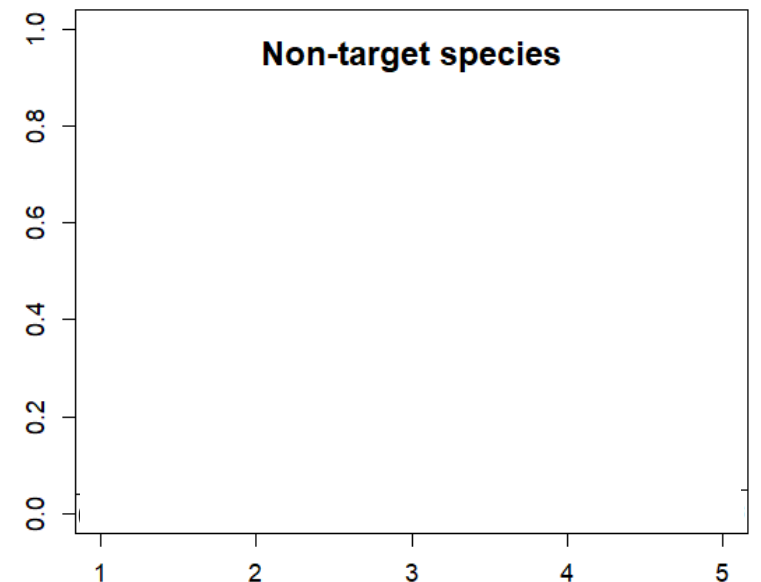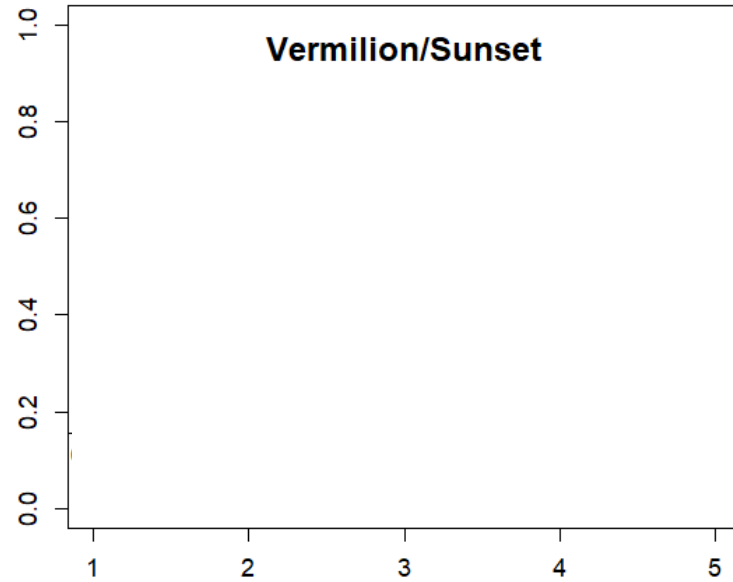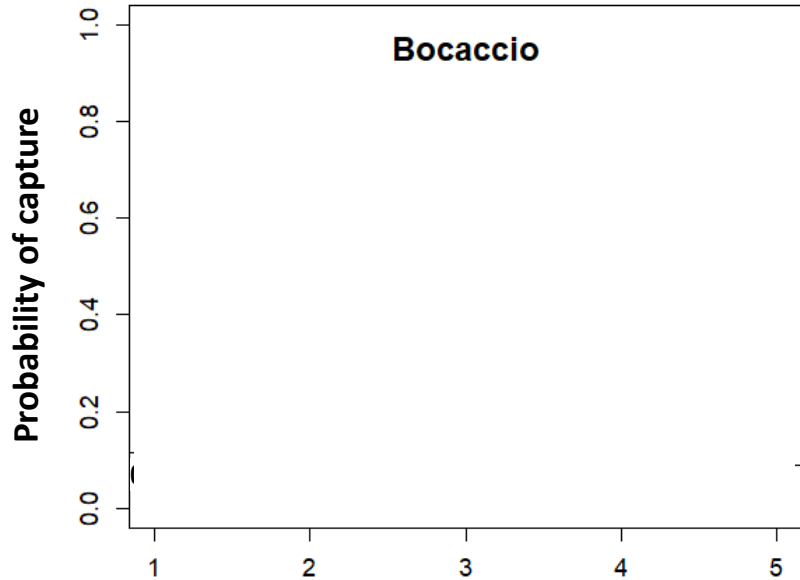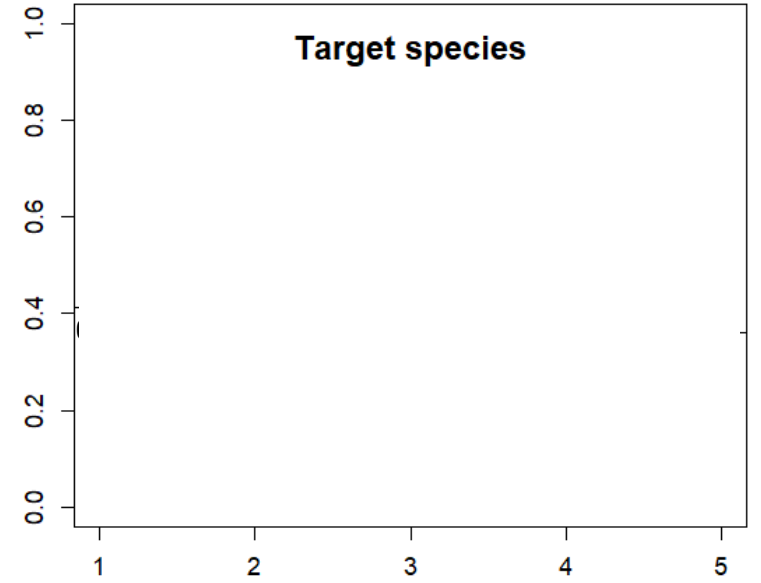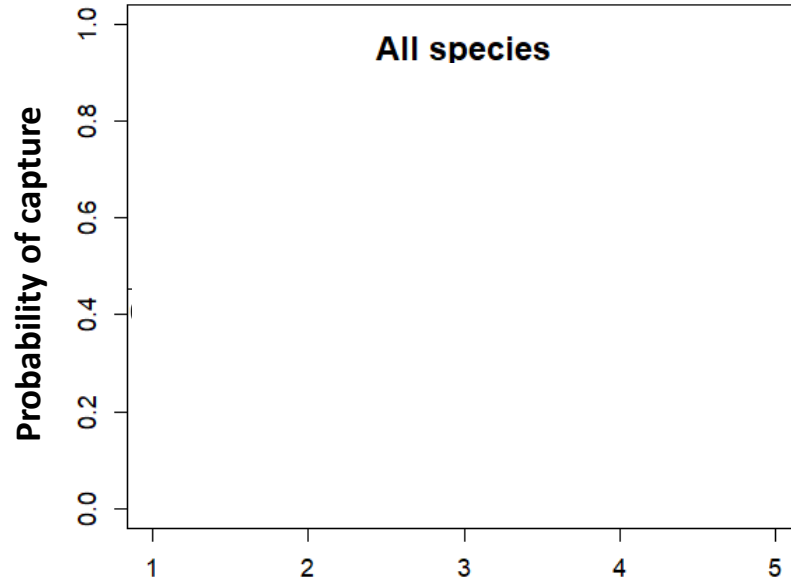
Temporal scale:

Short (1-2 h)

Abundance metrics

All models include:
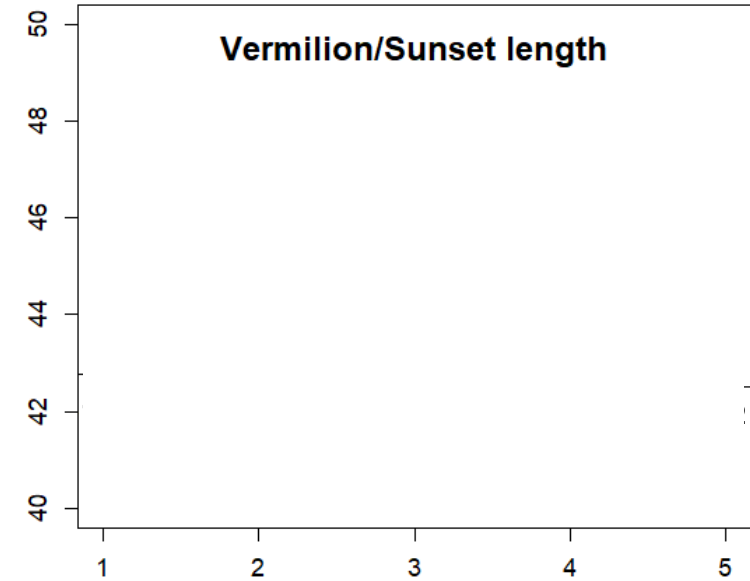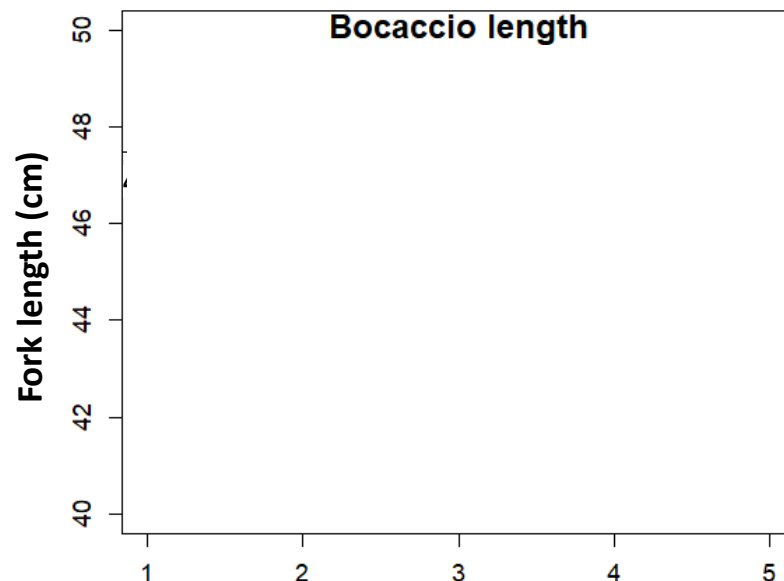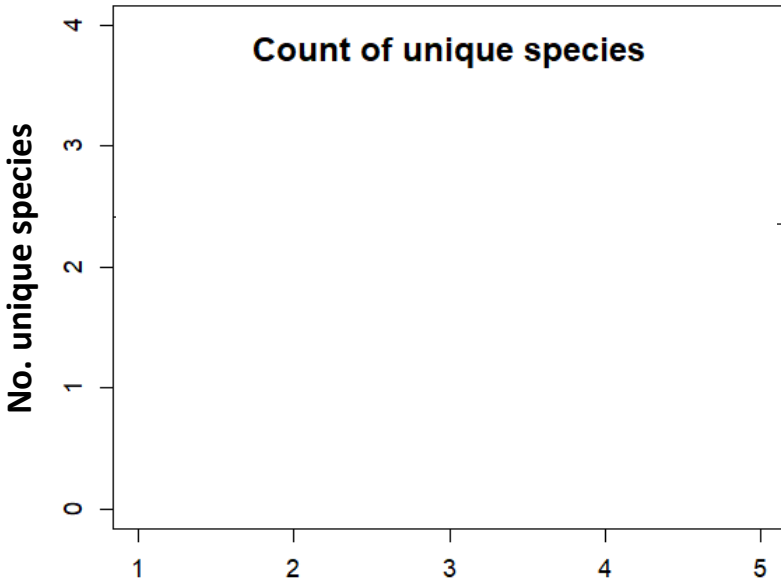
drop number (integer), site (factor), and year (factor)

Temporal scale: Short (1-2 h)

Species richness and length metrics

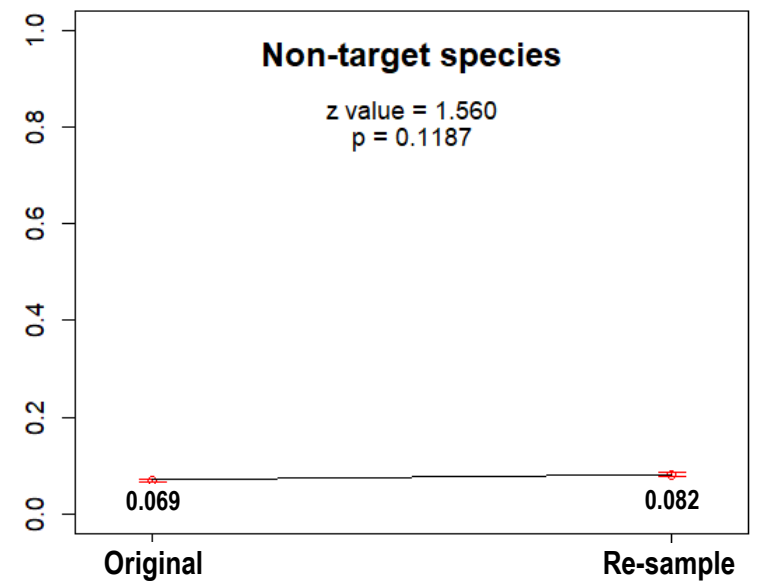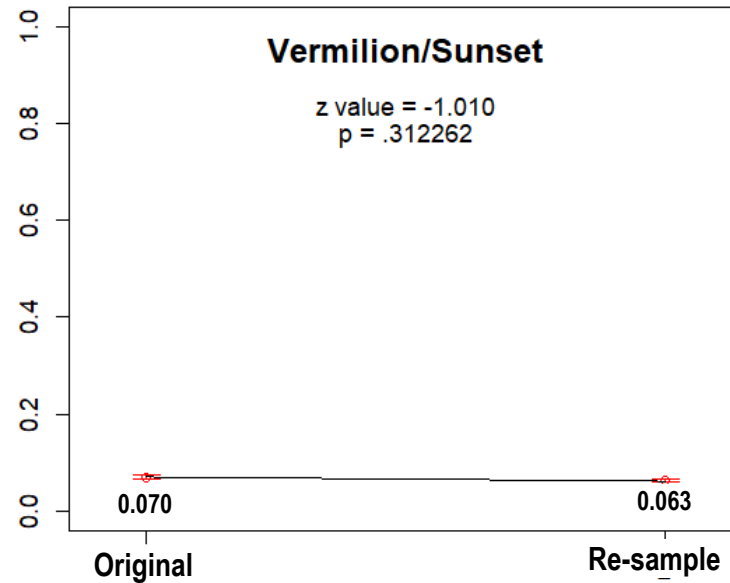**All models include: drop number (integer), site (factor), and year (factor)**
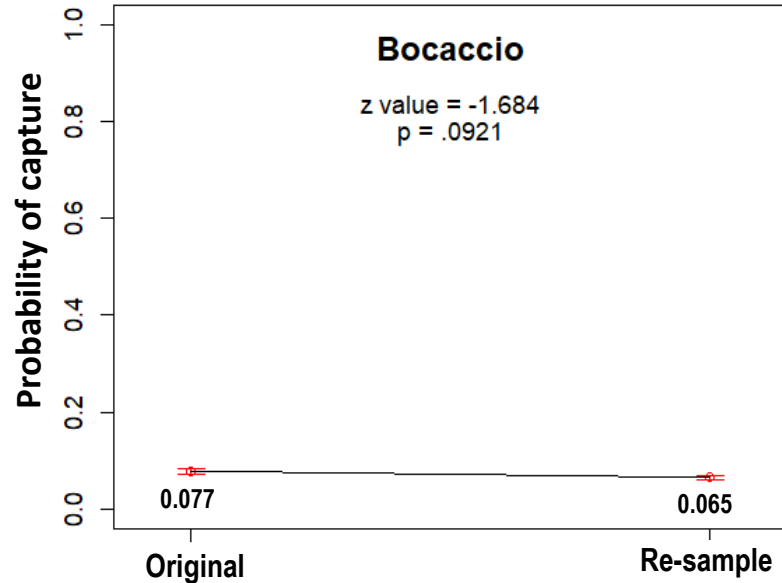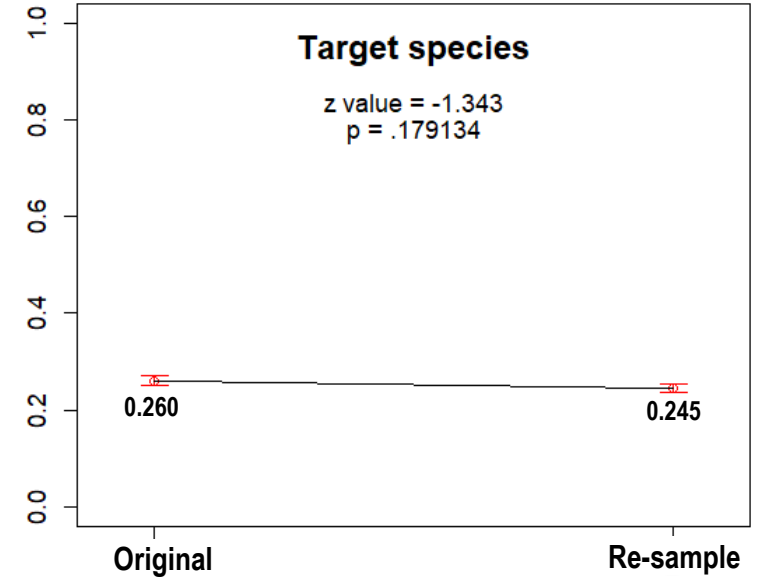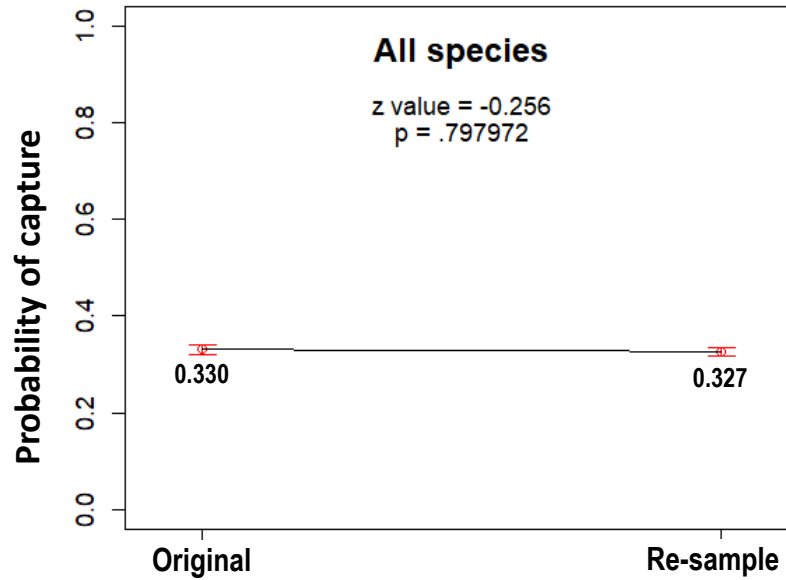
Temporal scale:

Medium (48-96 h)

Abundance metrics

All models include:

Sampling type (original / re-sample; factor) and site (factor)

All species

z value = -0.256
p = .797972

0.330   0.327

Target species

z value = -1.343
p = .179134

0.260   0.245

Bocaccio

z value = -1.684
p = .0921

0.077   0.065

Vermilion/Sunset

z value = -1.010
p = .312262

0.070   0.063

Non-target species

z value = 1.560
p = 0.1187

0.069   0.082
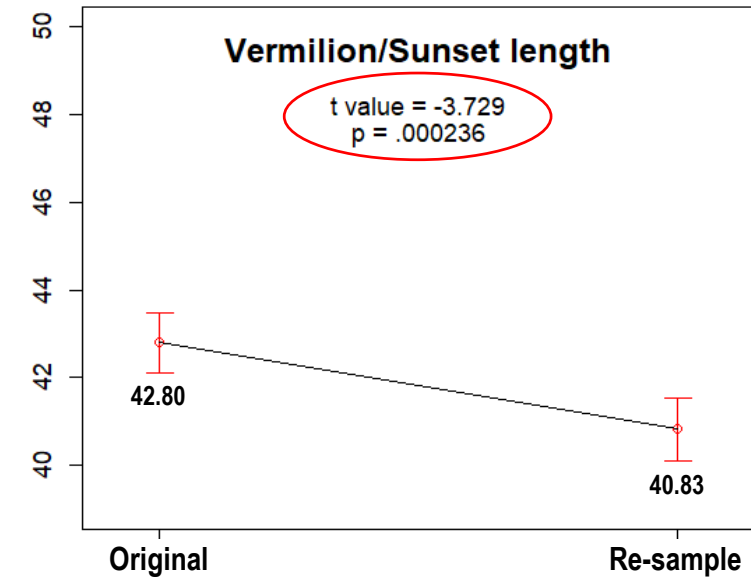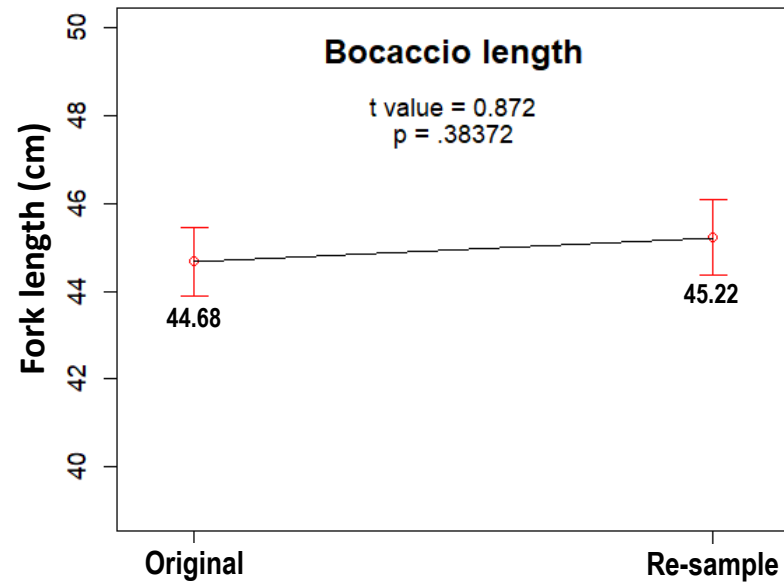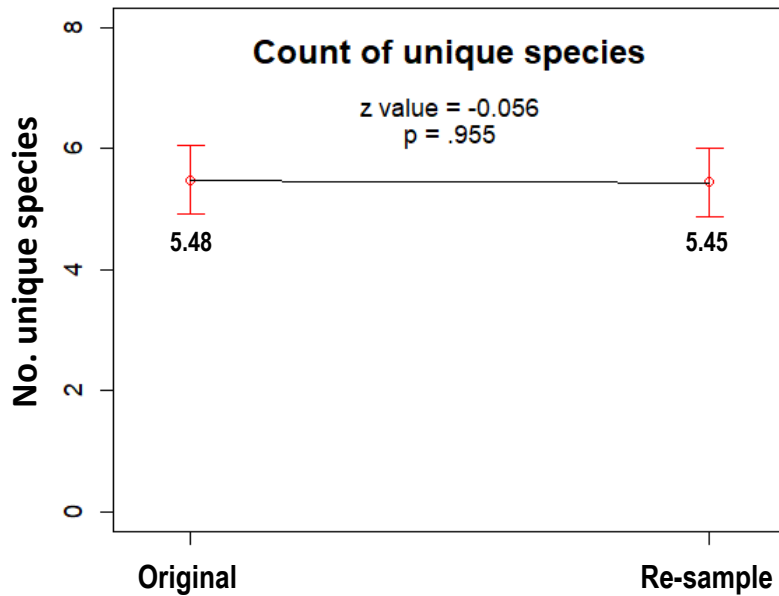
Probability of capture

Original   Re-sample

Sampling type

Temporal scale: Medium (48-96 h)

Species richness and length metrics

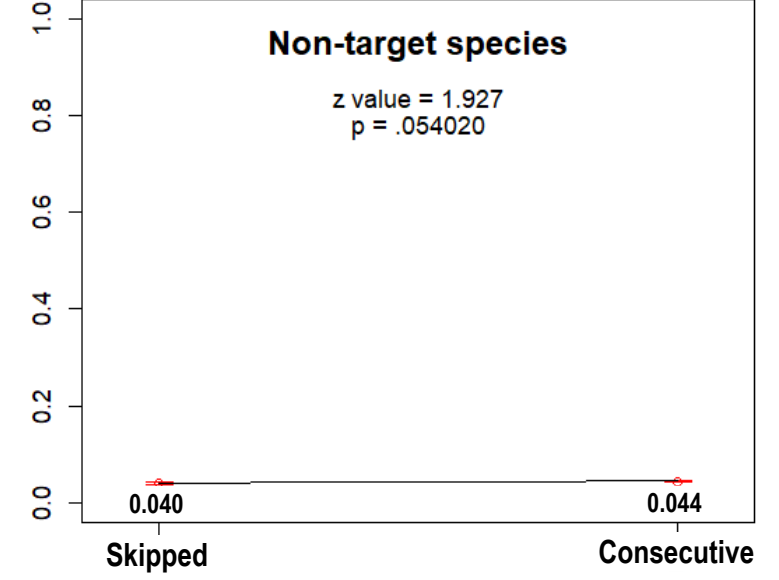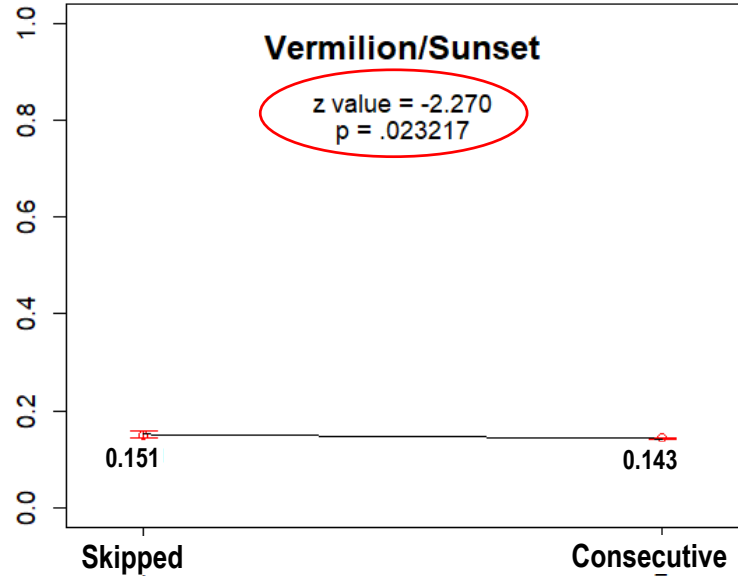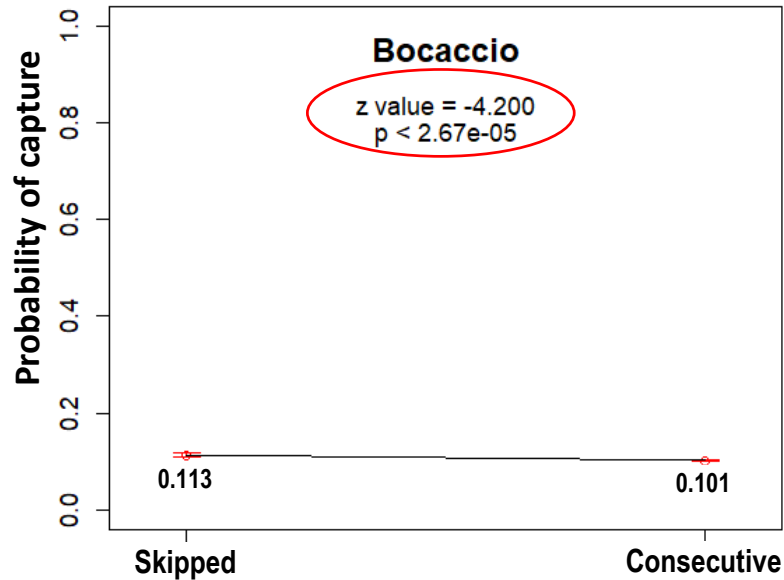**All models include: Sampling type (original or re-sample; factor) and site (factor)**

Temporal scale:

Long (1-5 yr)

Abundance metrics

All models include:

Sampling type (skipped or consecutive; factor), site (factor), and year (factor)

All species

z value = -7.052
p < 1.76e-12

0.460   0.427

Target species

z value = -8.609
p < 2e-16

0.421   0.383

Bocaccio

z value = -4.200
p < 2.67e-05

0.113   0.101

Vermilion/Sunset

z value = -2.270
p = .023217

0.151   0.143

Non-target species

z value = 1.927
p = .054020

0.040   0.044

Probability of capture

Skipped   Consecutive

Sampling type

Temporal scale: Long (1-5 yr)

Species richness and length metrics
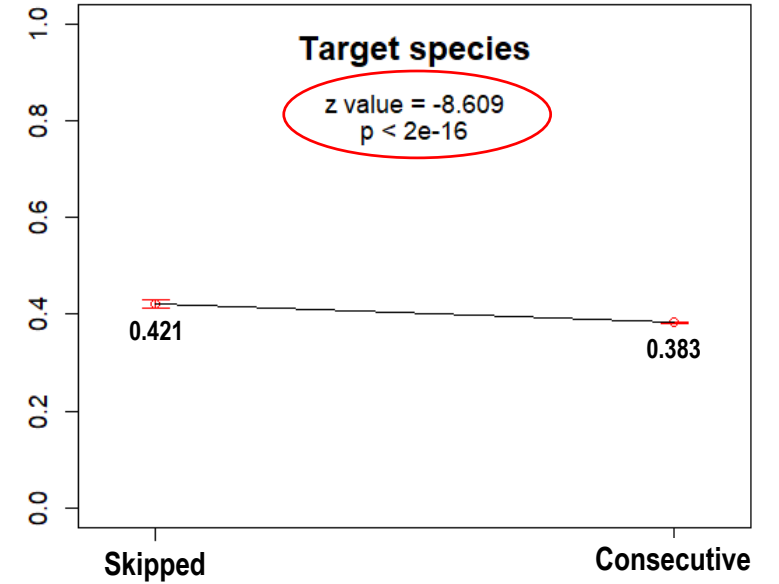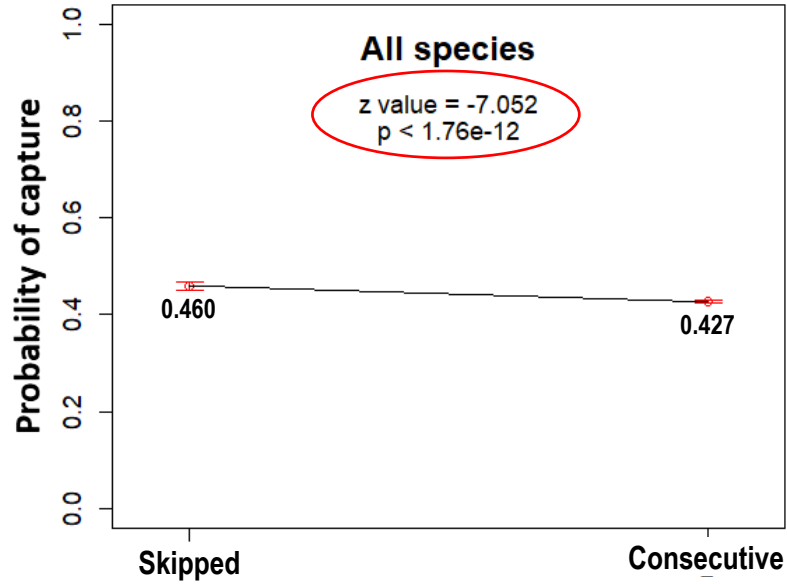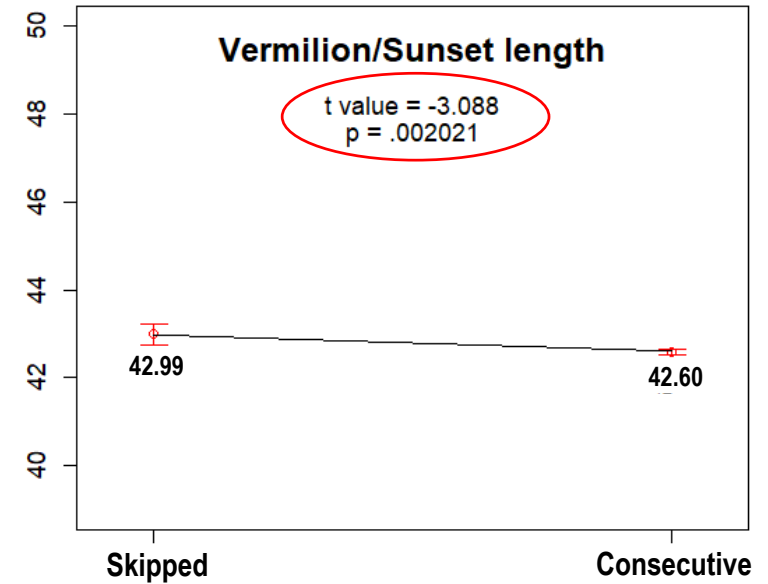
All models include: Sampling type (skipped or consecutive; factor), site (factor), and year (factor)

Count of unique species

z value = -0.266
p = .790457

No. unique species

5.21

5.15

Skipped   Consecutive

Bocaccio length

t value = -3.105
p = .001906

Fork length (cm)

47.75

47.17

Skipped   Consecutive

Vermilion/Sunset length

t value = -3.088
p = .002021

42.99

42.60

Skipped   Consecutive
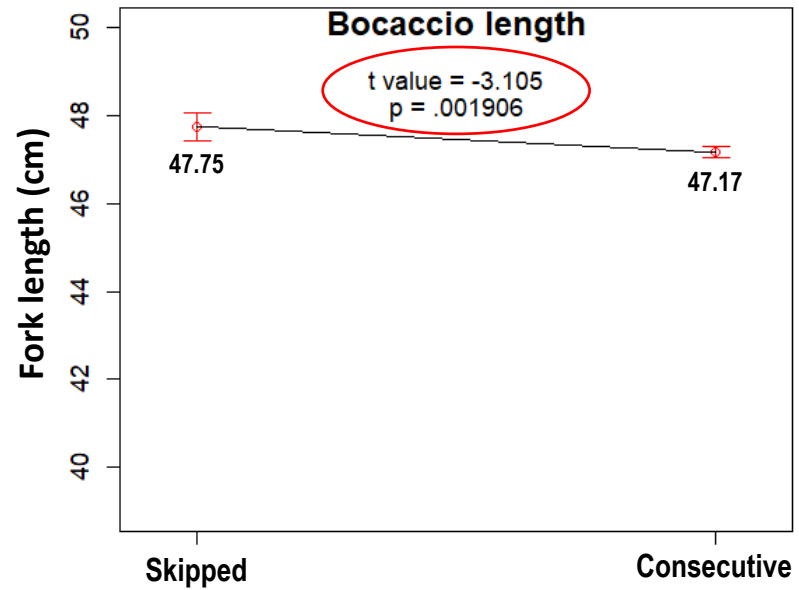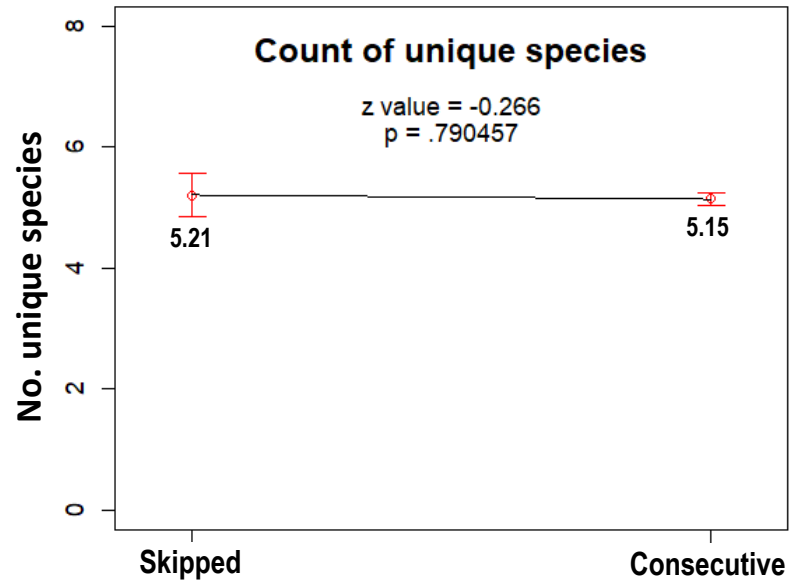
Sampling type

Summary of results

↓ or ↑: sign of coefficient

Red = negative and statistically significant

Green = positive and statistically significant

Impact metric		Temporal scale		
		Short (Drop 1 vs Drop 5)	**Medium** (Original vs Re-sample)	**Long** (Skipped vs Consecutive)
Capture probability	**All species**	**3.9 % ↓**	0.3 % ↓	**3.3 % ↓**
	Target species	**4.6 % ↓**	1.5 % ↓	**3.8 % ↓**
	Non-target species	**0.4 % ↑**	1.3 % ↑	0.4 % ↑
	Bocaccio	**2.5 % ↓**	1.2 % ↓	**1.2 % ↓**
	Vermilion/Sunset	**2.0 % ↓**	0.7 % ↓	**0.8 % ↓**
Species richness (count)		0.06 ↓	0.03 ↓	0.06 ↓
Bocaccio length		**0.44 cm ↓**	0.54 cm ↑	**0.58 cm ↓**
Vermilion/Sunset length		**0.23 cm ↓**	**1.97 cm ↓**	**0.39 cm ↓**

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Further analysis

- Skipped visits are not distributed randomly spatially or temporally

  ➢ Site*Year interaction term

- Many sites are regularly fished by the charter fleet and rec anglers

  ➢ Explore including a rough estimate for fishing pressure in the models at a regional scale

- Include number of elapsed years between sampling visits for skipped sites

Thanks!

Questions?