California Collaborative Fisheries Research Program

Data availability for stock assessments

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1 Summary

This document summarizes the data from the California Collaborative Fisheries Research Program (CCFRP) as well as the available data for the four species proposed for stock assessments in 2023, including black rockfish (*Sebastes melanops*), copper rockfish (*S. caurinus*), quillback rockfish (*S. maliger*), and yellowtail rockfish (*S. flavidus*). Preliminary analyses suggest the following data availability to inform stock assessments for each species:

Black rockfish: There are enough data to consider an index of abundance and also include ages in the assessment model.

Copper rockfish: There are enough data north of Point Conception to consider an index of abundance. The two MPAs south of Point Conception with consistent encounters of copper rockfish cover a very small fraction of the available habitat and were not included in the original sampling design. There are enough age data available north of Point Conception for inclusion in an assessment model. Otoliths will be collected south of Point Conception in 2022.

Quillback rockfish: There is only one MPA monitored north of the $40°10'N$ management boundary in California that was not part of the original sampling design and hence does not have a long time series. It is not likely that robust index can be developed from the sparse data separately north and south of $40°10'N$. An exploration of an index could be considered if California is modeled as one area. Age data are available t hat could inform growth external to the assessment model.

Yellowtail rockfish: There are enough data to consider an index of abundance north of Point Conception for yellowtail rockfish as well as include age data from the otoliths within the assessment model.

2 Survey Background

The 1999 Marine Life Protection Act resulted in the creation of a network of Marine Protected Areas (MPAs) along California's coast. The state of California designated both State Marine Reserves (SMRs) and State Marine Recreational Management areas (SMCAs). The SMRs prohibit all recreational and commercial take and SMCAs allow some recreational and/or commercial take that varies by SMCA. A number of MPAs consist of an SMR adjacent to an SMCA, of which the SMR is closer to shore. The California Collaborative Fisheries Research Program, CCFRP, is a fishery-independent hook-and-line survey designed to monitor nearshore fish populations at a series of sampling locations both inside and adjacent to California's network of MPAs.

The CCFRP survey began in 2007 with Cal Poly and Moss Landing Marine Labs in collaboration with NMFS scientists and the fishing community. The core area of the survey includes Año Nuevo SMR and Point Lobos SMR sampled by San Jose State University Moss Landing Marine Lab, and Point Buchon

SMR and Piedras Blancas SMR sampled by California Polytechnic University San Luis Obispo (Figure 1). In 2017, CCFRP expanded within California to include four additional partners, Cal Poly Humboldt (formerly Humboldt State University), University of California Davis' Bodega Marine Lab, University of California Santa Barbara, and the Scripps Institute of Oceanography. The CCFRP now monitors 12 MPA and reference area pairs (Table 1). Cal Poly Humboldt samples the furthest north sites, which are south of Cape Mendocino, but north of the management line at $40°10'N$. There are three nearshore SMCAs north of Cape Mendocino that were not selected for CCFRP monitoring due to historical sampling the tiers assigned to the SMRs by CDFW. The COVID-19 pandemic also affected the survey effort, but all partners were able to conduct sampling in 2000 and 2001.

The CCFRP survey design is consistent across all partners. Each MPA and reference area consists of a number of 500 x 500 m cells that were selected because the contained appropriate rockfish habitat. The survey was designed as a capture and release survey, with a sub-study tag/recapture program. Therefore, CCFRP restricts sampling areas to depths shallower than approximately 120 feet in order to reduce potential effects of barotrauma. On any given survey day site cells are randomly selected within a stratum (MPA and/or reference cells). Commercial passenger fishing vessels (CPFVs) are chartered for the survey and the captain is allowed to search within the cell for a fishing location. Due to the nature of the fishery in northern California, Cal Poly Humboldt conducts sampling aboard 6-pack vessels, and therefore fishes for fewer total angler hours per year compared to the other partners (Tables 2 and 3). During a sampling event, each cell is fished for a total of 30-45 minutes by volunteer anglers. Volunteer anglers are allowed to reel up their lines at any time during a fishing drop if they think they've hooked fish. Anglers can then re-bait and continue fishing until the the drop is complete. Each fish encountered can be linked back to an angler. Each anglers fishes one line, with two hooks. The jig and bait is assigned to each angler, but an angler may fish with a personal fishing rod.

All fish encountered are measured to the nearest centimeter (fork length), and the majority of fish are released or descended to depth. A total of 58498 fish were tagged since 2007, and recapture data are available from each partner. Starting in 2017, at the request of Melissa Monk (NMFS SWFSC), a fraction of the fish encountered in the reference cells have been retained to collect otoliths and fin clips that provide needed biological information for nearshore species. In 2022, the goal is to increase biological collections for commonly encountered species for use in the 2023 stock assessments.

3 Available Data for Indices

From 2007-2021 a total of 698 fishing trips were taken, consisting of 9634 fishing drops. When the CCFRP expanded in 2017, some MPAs/sites were fished in only one or two years during an exploratory phase. These included Laguna Beach, the southeast Farallon Islands, Point Conception and Trinidad, which were excluded from this summary since we would not include them in a stock assessment. Fishing drops that drifted outside a cell were also excluded. These site filter result in an available 7910. The final filter removed drifts within a cell that were not fished for at least ten minutes within a sampling occasion, resulting in a total of 7889 fishing drops available for analyses for stock assessments. The total nubmer of fish encountered by CCFRP partner and the percent of positive drops by species and MPA can be found in Tables 4 - 8.

4 Available Lengths and Otoliths

The CCFRP measures every fish to the nearest centimeter and distributions of the lengths inside and outside the MPAs by MPA and species are in Figures 2 - 5. Length data were filtered to the drifts included in the final data set. Any species and MPA combination with fewer than 20 observed fish in an MPA or reference area over the entirety of the program were removed from the length plots.

The total number of fish retained by university partner can be found in Table 9. This represents that maximum number of available otoliths, which will be verified once the stock assessments for 2023 are verified.

The rule of thumb for including conditional age-at-length samples is a minimum of 30 available fish in a year/fleet stratum. Given this, there are likely not enough fish from Bodega or Cal Poly for any species.

5 Tables

Table 1: Monitoring groups and the associated MPAs they sample. The abbreviated names will be used throughout most of the tables in this document

Monitoring Group	Abbreviated Name	MPA
Cal Poly Humboldt	Humboldt	South Cape Mendocino
Cal Poly Humboldt	Humboldt	Ten Mile
Bodega Marine Lab	Bodega	Stewarts Point
Bodega Marine Lab	Bodega	Bodega Head
Moss Landing Marine Lab	Moss Landing	Ano Nuevo
Moss Landing Marine Lab	Moss Landing	Point Lobos
Cal Poly SLO	Cal Poly	Piedras Blancas
Cal Poly SLO	Cal Poly	Point Buchon
UC Santa Barbara	UCSB	Carrington Point
UC Santa Barbara	UCSB	Anacapa Island
Scripps Institute Ocean.	Scripps	Swamis
Scripps Institute Ocean.	Scripps	South La Jolla

Table 2: Total angler hours by institution summed across all active years.

YEAR	Humboldt	Bodega	Moss Landing	Cal Poly	UCSB	Scripps
2007	0	0	450	277	0	0
2008	0	0	639	455	0	0
2009	0	0	343	339	0	0
2010	0	0	406	440	0	0
2011	0	0	459	393	0	0
2012	0	0	526	422	0	0
2013	0	0	484	376	0	0
2014	0	0	522	473	0	0
2015	0	0	264	272	0	0
2016	0	0	524	532	0	0
2017	157	92	383	507	137	127
2018	136	353	330	373	230	186
2019	132	403	365	340	222	240
2020	103	143	198	222	227	105
2021	127	219	305	246	271	109

Table 3: Total number of fishing drops by year at each monitored site in the reference areas and inside the MPAs, in parentheses.

YEAR	Cal Poly Humboldt		Bodega Marine Lab		Moss Landing		Cal Poly SLO		UC Santa Barbara		Scripps	
	South Cape Mendocino	Ten Mile	Stewarts Point	Bodega Head	Ano Nuevo	Point Lobos	Piedras Blancas	Point Buchon	Carrington Point	Anacapa Island	Swamis	South La Jolla
2007	-	-	-	-	125(72)	70(93)	-	64(71)	-	-	-	-
2008	-	-	-	-	90(101)	74(82)	30(45)	62(65)	-	-	-	-
2009	-	-	-	-	78(45)	38(45)	38(35)	46(40)	-	-	-	-
2010	-	-	-	-	76(80)	45(48)	44(39)	44(46)	-	-	-	-
2011	-	-	-	-	54(58)	40(49)	42(36)	44(42)	-	-	-	-
2012	-	-	-	-	63(62)	50(48)	40(39)	45(43)	-	-	-	-
2013	-	-	-	-	66(71)	58(53)	41(38)	40(52)	-	-	-	-
2014	-	-	-	-	66(77)	57(55)	46(46)	50(44)	-	-	-	-
2015	-	-	-	-	37(39)	24(27)	-	49(49)	-	-	-	-
2016	-	-	-	-	66(57)	47(50)	47(57)	48(49)	-	-	-	-
2017	38(34)	44(43)	13(9)	15(14)	59(48)	35(37)	44(46)	48(48)	17(17)	14(7)	9(7)	10(21)
2018	36(33)	34(35)	47(54)	36(34)	54(50)	31(34)	34(35)	36(34)	29(26)	21(16)	16(6)	22(28)
2019	34(35)	32(36)	50(60)	41(40)	47(46)	35(38)	34(32)	36(39)	25(27)	19(12)	12(13)	24(23)
2020	30(36)	34(35)	26(46)	43(39)	59(51)	34(44)	35(30)	35(35)	36(36)	23(11)	9(10)	26(33)
2021	37(35)	35(33)	28(41)	38(31)	51(46)	38(41)	32(36)	33(35)	31(35)	20(12)	6(8)	23(28)

Table 4: Total number of fish encountered by each monitoring group.

Common.Name	Humboldt	Bodega	Moss Landing	Cal Poly	UCSB	Scripps
Black Rockfish	1296	1488	13272	1744	2	0
Copper Rockfish	365	509	901	1008	2352	46
Quillback Rockfish	220	39	1	1	0	0
Yellowtail Rockfish	482	979	1828	1029	6	0

Table 5: Percent of drifts with encounters of Black Rockfish in each at each monitoring location and yerar.

YEAR	South Cape Mendocino	Ten Mile	Stewarts Point	Bodega Head	Ano Nuevo	Point Lobos	Piedras Blancas	Point Buchon	Carrington Point	Anacapa Island	Swamis	South La Jolla
2007	-	-	-	-	70%	26%	-	34%	-	-	-	-
2008	-	-	-	-	74%	24%	10%	46%	-	-	-	-
2009	-	-	-	-	78%	10%	2%	30%	-	-	-	-
2010	-	-	-	-	56%	6%	2%	8%	-	-	-	-
2011	-	-	-	-	74%	18%	8%	38%	-	-	-	-
2012	-	-	-	-	82%	20%	14%	58%	-	-	-	-
2013	-	-	-	-	88%	28%	32%	52%	-	-	-	-
2014	-	-	-	-	84%	38%	28%	50%	-	-	-	-
2015	-	-	-	-	86%	50%	-	40%	-	-	-	-
2016	-	-	-	-	86%	36%	22%	32%	-	-	-	-
2017	54%	22%	50%	38%	76%	18%	4%	24%	-	-	-	-
2018	46%	30%	56%	12%	70%	10%	2%	28%	-	-	-	-
2019	44%	26%	56%	36%	68%	2%	4%	6%	-	-	-	-
2020	44%	40%	46%	48%	66%	-	4%	8%	-	-	-	-
2021	60%	48%	68%	48%	76%	2%	6%	4%	2%	-	-	-

Table 6: Percent of drifts with encounters of Copper Rockfish in each at each monitoring location and yerar.

YEAR	South Cape Mendocino	Ten Mile	Stewarts Point	Bodega Head	Ano Nuevo	Point Lobos	Piedras Blancas	Point Buchon	Carrington Point	Anacapa Island	Swamis	South La Jolla
2007	-	-	-	-	2%	30%	-	6%	-	-	-	-
2008	-	-	-	-	2%	16%	38%	10%	-	-	-	-
2009	-	-	-	-	2%	30%	54%	4%	-	-	-	-
2010	-	-	-	-	2%	22%	34%	6%	-	-	-	-
2011	-	-	-	-	6%	30%	38%	2%	-	-	-	-
2012	-	-	-	-	8%	26%	44%	6%	-	-	-	-
2013	-	-	-	-	6%	10%	30%	12%	-	-	-	-
2014	-	-	-	-	6%	42%	54%	6%	-	-	-	-
2015	-	-	-	-	6%	34%	-	10%	-	-	-	-
2016	-	-	-	-	8%	46%	46%	14%	-	-	-	-
2017	22%	24%	22%	32%	4%	38%	46%	10%	98%	38%	12%	20%
2018	60%	24%	30%	24%	8%	44%	52%	22%	100%	36%	4%	8%
2019	26%	26%	32%	54%	6%	46%	60%	20%	100%	36%	4%	10%
2020	34%	34%	28%	38%	2%	44%	56%	22%	98%	50%	-	10%
2021	42%	24%	42%	42%	10%	52%	52%	18%	94%	50%	-	18%

Table 7: Percent of drifts with encounters of Quillback Rockfish in each at each monitoring location and yerar.

YEAR	South Cape Mendocino	Ten Mile	Stewarts Point	Bodega Head	Ano Nuevo	Point Lobos	Piedras Blancas	Point Buchon	Carrington Point	Anacapa Island	Swamis	South La Jolla
2007	-	-	-	-	-	-	-	-	-	-	-	-
2008	-	-	-	-	-	-	-	-	-	-	-	-
2009	-	-	-	-	-	-	-	-	-	-	-	-
2010	-	-	-	-	-	-	-	-	-	-	-	-
2011	-	-	-	-	-	-	-	-	-	-	-	-
2012	-	-	-	-	-	-	-	-	-	-	-	-
2013	-	-	-	-	-	-	-	-	-	-	-	-
2014	-	-	-	-	-	-	-	2%	-	-	-	-
2015	-	-	-	-	2%	-	-	-	-	-	-	-
2016	-	-	-	-	-	-	-	-	-	-	-	-
2017	20%	20%	4%	10%	-	-	-	-	-	-	-	-
2018	46%	24%	2%	8%	-	-	-	-	-	-	-	-
2019	30%	8%	2%	2%	-	-	-	-	-	-	-	-
2020	28%	14%	4%	4%	-	-	-	-	-	-	-	-
2021	24%	12%	6%	6%	-	-	-	-	-	-	-	-

Table 8: Percent of drifts with encounters of Yellowtail Rockfish in each at each monitoring location and yerar.

YEAR	South Cape Mendocino	Ten Mile	Stewarts Point	Bodega Head	Ano Nuevo	Point Lobos	Piedras Blancas	Point Buchon	Carrington Point	Anacapa Island	Swamis	South La Jolla
2007	-	-	-	-	10%	14%	-	26%	-	-	-	-
2008	-	-	-	-	4%	10%	18%	16%	-	-	-	-
2009	-	-	-	-	16%	26%	20%	26%	-	-	-	-
2010	-	-	-	-	8%	16%	12%	8%	-	-	-	-
2011	-	-	-	-	14%	38%	8%	10%	-	-	-	-
2012	-	-	-	-	10%	30%	12%	20%	-	-	-	-
2013	-	-	-	-	18%	30%	40%	40%	-	-	-	-
2014	-	-	-	-	20%	56%	22%	18%	-	-	-	-
2015	-	-	-	-	22%	50%	-	30%	-	-	-	-
2016	-	-	-	-	24%	30%	28%	16%	-	-	-	-
2017	6%	18%	46%	4%	38%	24%	12%	14%	6%	-	-	-
2018	18%	24%	72%	14%	8%	46%	14%	16%	-	-	-	-
2019	14%	24%	46%	6%	14%	16%	14%	10%	2%	-	-	-
2020	22%	46%	72%	4%	22%	14%	22%	10%	4%	-	-	-
2021	30%	42%	78%	18%	28%	34%	16%	32%	-	-	-	-

Table 9: Total number of fish retained by monitoring group and year.

Common Name	Humboldt	Bodega	Moss Landing	Cal Poly
Black Rockfish	187	52	142	14
Copper Rockfish	104	17	20	29
Quillback Rockfish	62	0	0	0
Yellowtail Rockfish	120	36	19	13

6 Figures

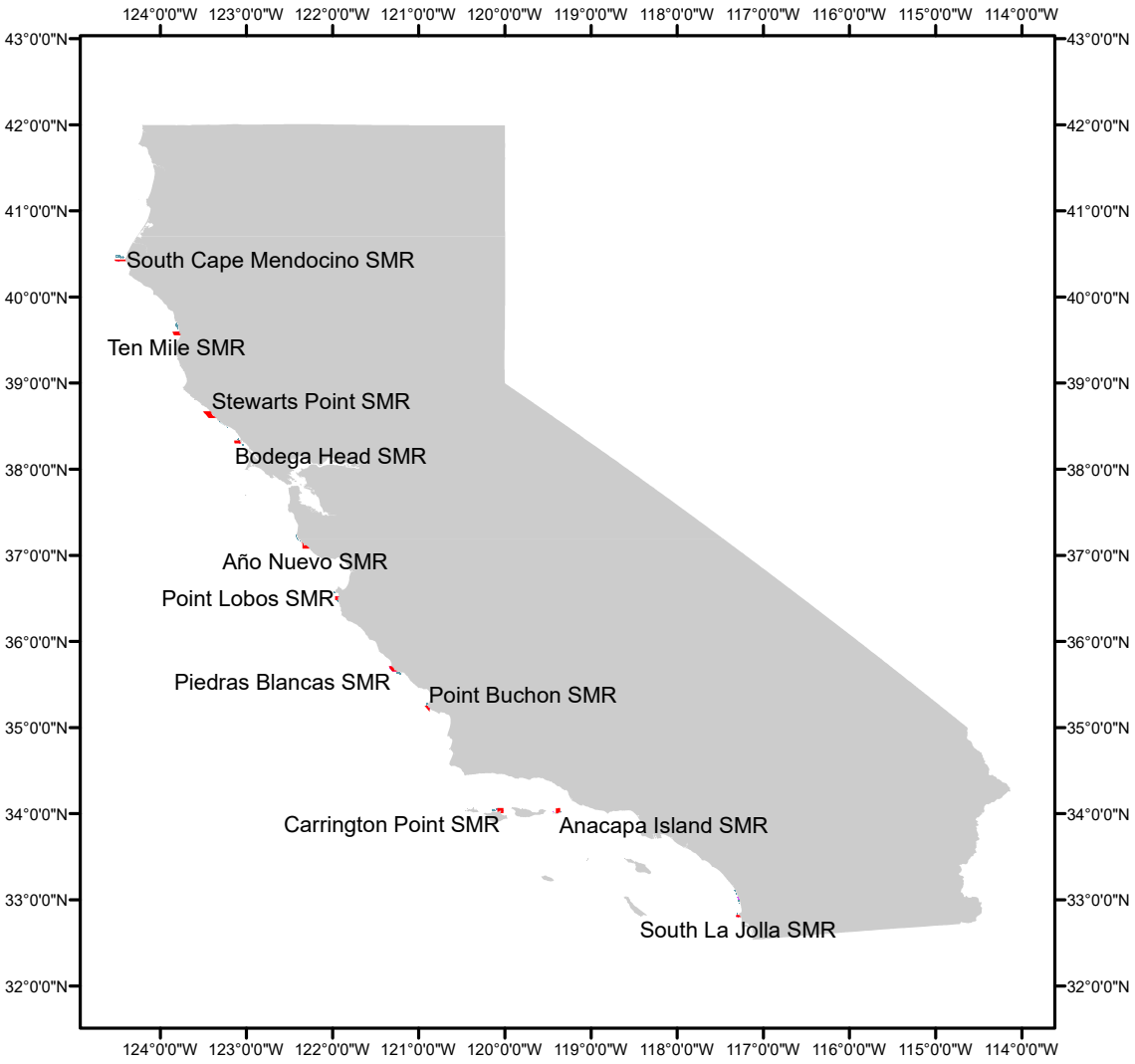

Figure 1: Map of the State Marine Reserves (SMRs) monitored by the CCFRP program.

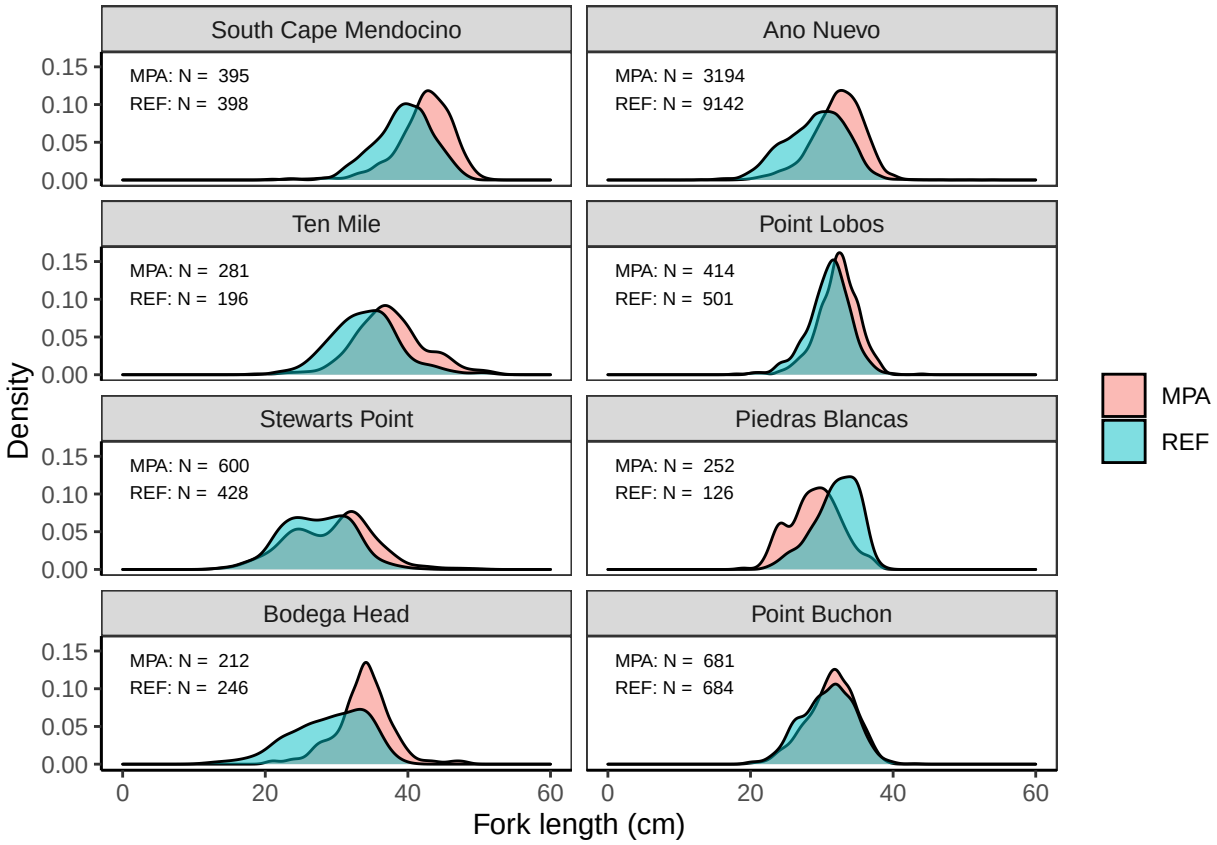

Figure 2: Density plot of Black Rockfish fork length bins encountered inside each MPA and outside at reference areas (REF) A sample size of NA indicates fewer than 20 fish were encountered in that MPA stratum and were not plotted.

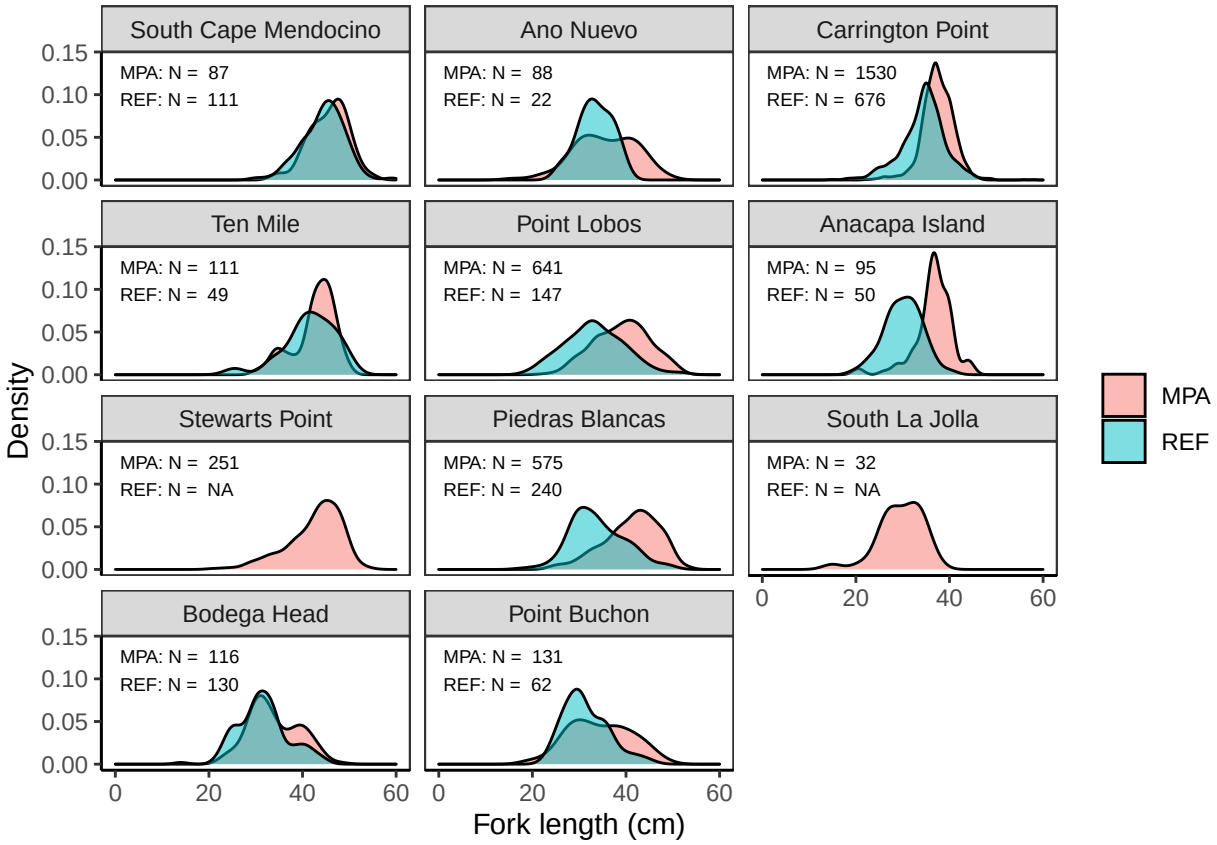

Figure 3: Density plot of Copper Rockfish fork length bins encountered inside each MPA and outside at reference areas (REF) A sample size of NA indicates fewer than 20 fish were encountered in that MPA stratum and were not plotted.

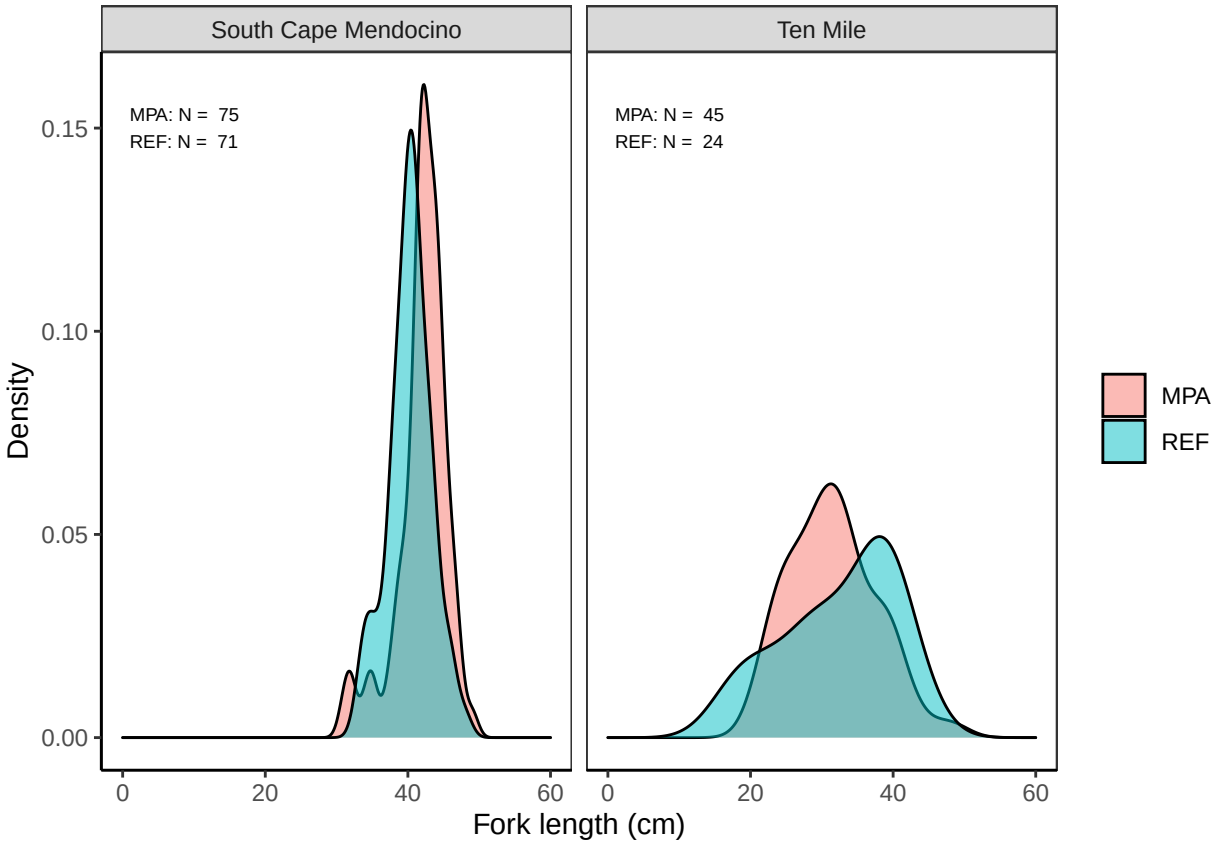

Figure 4: Density plot of Quillback Rockfish fork length bins encountered inside each MPA and outside at reference areas (REF) A sample size of NA indicates fewer than 20 fish were encountered in that MPA stratum and were not plotted.

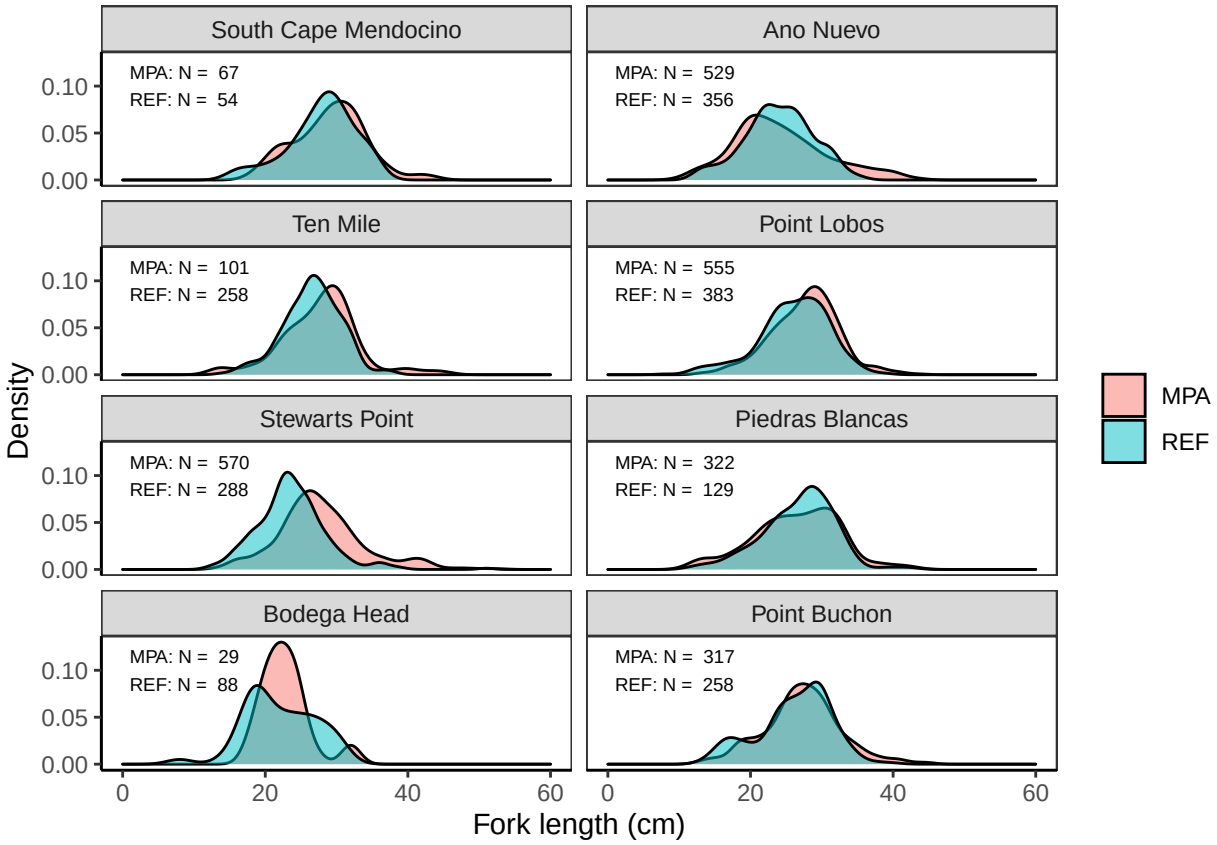

Figure 5: Density plot of Yellowtail Rockfish fork length bins encountered inside each MPA and outside at reference areas (REF) A sample size of NA indicates fewer than 20 fish were encountered in that MPA stratum and were not plotted.