

Submitted by Clay Bezenek

**Demersal Shelf Rockfish and Yelloweye Rockfish Summary for Clay Bezenek
Compiled by Rhea Ehresmann 12/15/21**

DEMERSAL SHELF ROCKFISHES

The demersal shelf rockfish (DSR) complex is comprised of seven rockfish species: yelloweye, quillback, copper, rosethorn, China, canary, and tiger rockfish, with yelloweye making up the majority of the harvest. All DSR are considered highly K-selective, exhibiting slow growth, late maturity, and extreme longevity (Archibald et al. 1981, Haldorson and Love 1991, Love et al. 2002). Estimates of natural mortality are very low. These species of fish are very susceptible to over-exploitation and are slow to recover once driven below the level of sustainable yield (Leaman and Beamish 1984, Francis 1985). An acceptable exploitation rate is assumed to be very low (Dorn 2000).

FISHERY DEVELOPMENT AND HISTORY

DSR have been the target of a directed shore-based longline fishery in Southeast since the late 1970s. The fishery began in the Sitka Sound area as a small family-run, fresh-fish business, catching primarily black rockfish from skiffs using automatic jigging machines, and by 1982, longline gear had replaced jigging machines. The use of longline gear in the fishery changed the dynamics and target species of the fishery, where the catch became predominately yelloweye and quillback rockfish. Harvest increased six-fold in five years with total catch exceeding one million round pounds in 1986. A directed DSR fishery developed in EYKT in 1991, primarily targeting yelloweye rockfish on the Fairweather Grounds. The majority of the DSR harvest has occurred in EYKT, CSEO, and SSEO, while DSR harvest in internal waters has occurred on a smaller scale. Fishing has been open to directed DSR fishing in the internal waters of both NSEI and SSEI since 2003; however, due to an overall decline in estimated yelloweye rockfish biomass from the most recent stock assessment surveys and signs of age truncation in biological data, the DSR directed fishery was closed in both outside and inside waters in 2020.

REGULATION DEVELOPMENT

The state has regulated the harvest of DSR in Southeast since the 1980s. In 1987, GHs for the directed DSR fishery were first set by management area under a draft management plan and directed commercial fishing for DSR was closed in a portion of Sitka Sound after public testimony emphasized a concern regarding localized stock depletion. In 1989, legal gear for DSR was defined as hook-and-line only.

The DSR fishery in SEO has been managed since 1993 using a TAC based on a harvest rate applied to a biomass estimate (O'Connell and Carlile 1993, O'Connell and Brylinsky 2001). The directed DSR fishery has been managed with separate seasons following the implementation of the halibut individual fishing quota (IFQ) fishery. In 1997, regulations were adopted to reflect this management with 67% of the TAC allocated to the winter fishery season and 33% to the fall fishery season.

In 2006, the board allocated the DSR TAC between commercial and sport sectors with 84% to commercial and 16% to sport, and in 2009, the board adopted a proposal to deduct the subsistence catch from the DSR TAC prior to the allocation between the commercial and sport sectors.

Regulations have been developed to reduce the at-sea discard of DSR due to their high post-release mortality caused from exposure to pressure changes experienced between catch depth and surface waters. Full retention was required of all DSR captured in state waters of Southeast in 2000, and in 2009, was restricted to groundfish and halibut fisheries only. In state waters, a CFEC permit holder must retain,

weigh, and report all DSR taken, and any excess of the allowable bycatch limits must be reported as bycatch overage on a fish ticket. Proceeds from the sale of excess DSR are forfeited to the State of Alaska. DSR in excess of legal bycatch limits may be retained for personal use or donated. Full retention of DSR has been required in groundfish and halibut fisheries in federal waters since 2005. DSR bycatch overage taken in federal waters cannot enter commerce.

STOCK ASSESSMENT AND MANAGEMENT – ROV SURVEY

The department conducts a multi-year stock assessment survey for DSR in SEO. Biomass is estimated by management area as the product of yelloweye rockfish density, the area of rocky habitat within the 100-fathom contour, and the yelloweye rockfish average weight (O’Connell and Carlile 1993, Brylinsky et al. 2007). Yelloweye rockfish density for the annual stock assessment is based on the most recent estimate by management area. These densities are multiplied by the average weight of yelloweye rockfish from the commercial directed DSR and halibut longline fisheries for the current year and management area.

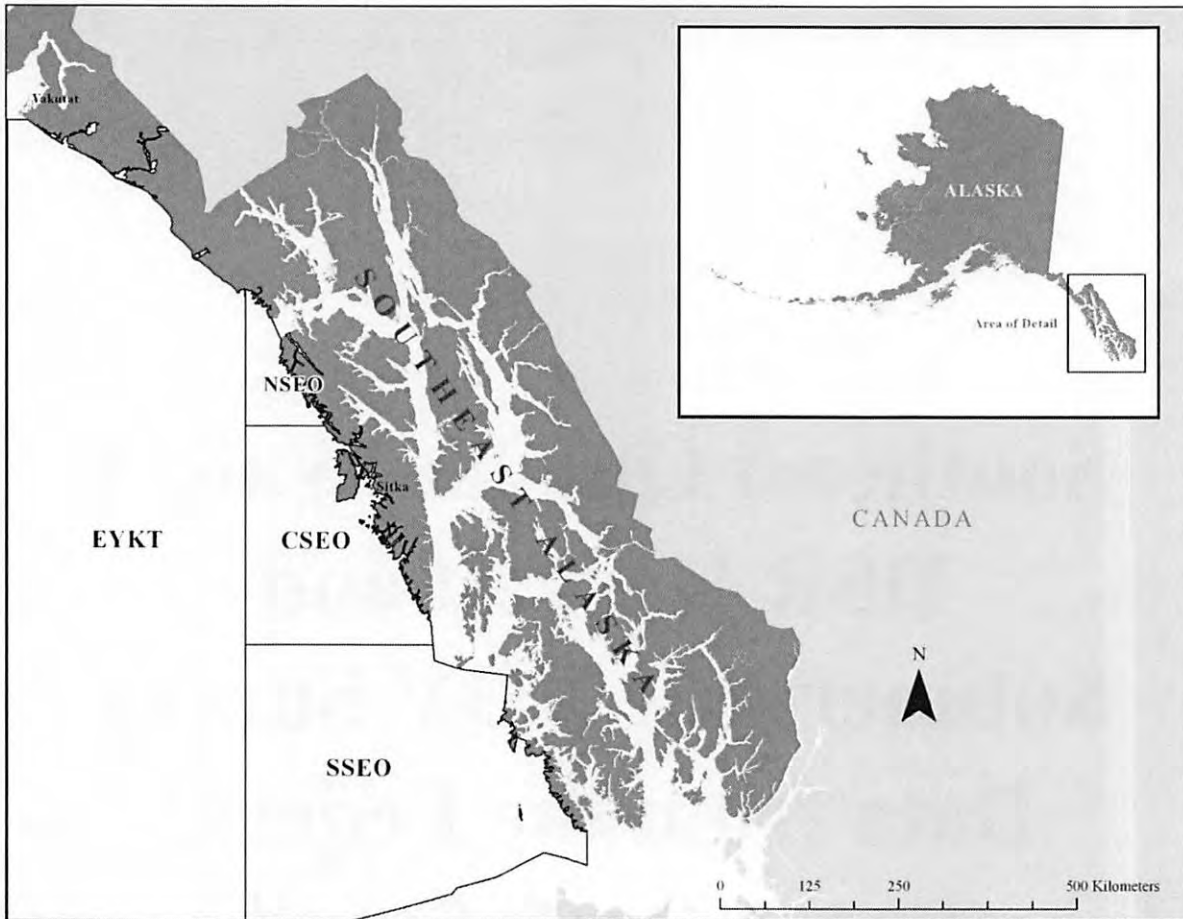
Yelloweye rockfish density is estimated using distance sampling methods along line transects (Buckland et al. 1993, Burnham et al. 1980, Thomas et al. 2010). From 1994–2009, a manned submersible was used to survey yelloweye rockfish; however, due to high costs and lack of submersible availability, the department began conducting line transects with a remote operated vehicle (ROV) in 2012. Side-by-side analysis of data obtained from ROV and submersible surveys indicates that the ROV is an appropriate survey tool to assess yelloweye rockfish stocks and provides estimates that are comparable to those produced with the submersible (O’Connell and Carlile 1994). All four of the SEO management areas have been surveyed with the ROV: CSEO in 2012, 2016, and 2018; SSEO in 2013, 2018, and 2020; EYKT in 2015, 2017, and 2019; NSEO in 2016 and 2018. The most recent estimates of yelloweye rockfish density by management area are as follows: 898 ye/km² in CSEO, 1,624 ye/km² in SSEO (from the 2018 stock assessment survey), 1,562 ye/km² in EYKT, and 553 ye/km² in NSEO.

The allowable biological catch (ABC) for the DSR assemblage in SEO is set by multiplying the lower bound of the 90% confidence interval of yelloweye rockfish biomass for the region by the natural mortality rate (0.02) and average estimated harvest from commercial, sport, and subsistence fisheries of other species in the DSR assemblage, which is added to the yelloweye rockfish ABC. This method is more conservative than using $F_{10\%}$ (0.026) to determine the ABC. The overfishing level is set using a rate of $F_{35\%}$ (0.032). There is no stock assessment information available for NSEI and SSEI management areas where the GHL has historically been set annually at 55,125 round lb for each area or approximately at the midpoint of the GHR (110,000 round lb).

Overall, yelloweye rockfish biomass has been decreasing in SEO despite a conservative harvest strategy. Management for this species has improved with increased accounting of total DSR removals since 2004 and allocation of the resource between sport and commercial sectors since 2006. Additionally, in 2017, the department began an interdivisional, statewide rockfish initiative to develop long-term management strategies for yelloweye rockfish. The stock is not considered overfished, but due to the life history characteristics of this long-lived species and infrequent stock assessment surveys, fluctuations in yelloweye rockfish biomass may not be detected quickly. Due to this and a general decline in estimated biomass, the directed commercial, personal use, and sport fisheries were closed to DSR fishing in 2020.

**Southeast Outside Waters
DSR Harvest and
Submersible/ROV Survey
Data from the Federal
Assessment Draft found here:**

https://apps-afsc.fisheries.noaa.gov/Plan_Team/2021/GOAdsr.pdf



The Southeast Outside (SEO) Subdistrict with the Alaska Department of Fish and Game groundfish management areas used for managing the demersal shelf rockfish fishery: East Yakutat (EYKT), Northern Southeast Outside (NSEO), Central Southeast Outside (CSEO), and Southern Southeast Outside (SSEO) Sections.

Catch (t) of demersal shelf rockfish from research, directed commercial, incidental commercial, estimated unreported discards from the halibut fishery, recreational, subsistence, and total catch from all fisheries in the Southeast Outside (SEO) Subdistrict, 1992–October 2021. Also included are allowable biological catch (ABC), overfishing level (OFL), and total allowable catch (TAC) for 1992–2022. Commercial catch includes rebanded rockfish from 1992–1996 and also include discards at sea/at the dock and catch retained for personal use.

Year	Research	Directed	Incidental	Unreported Discards	Recreational ^b	Subsistence ^c	Total	ABC ^d	OFL ^d	TAC ^d
1992	0	362	168	191	16	8	745	550	-	550
1993	15	342	230	267	20	8	882	800	-	800
1994	4	383	268	283	34	8	980	960	-	960
1995	14	155	123	72	25	8	398	580	-	580
1996	12	345	94	135	28	8	622	945	-	945
1997	16	267	105	217	38	8	651	945	-	945
1998	2	241	119	175	47	8	592	560	-	560
1999	2	240	125	175	33	8	584	560	-	560
2000	8	183	105	150	53	8	507	340	-	340
2001	7	173	145	113	49	8	495	330	-	330
2002	2	136	148	128	47	8	469	350	480	350
2003	6	102	168	95	48	8	427	390	540	390
2004	2	174	155	170	60	8	568	450	560	450
2005	4	42	192	157	72	8	475	410	650	410
2006 ^e	2	0	204	49	87	8	350	410	650	410
2007 ^e	3	0	196	48	82	8	337	410	650	410
2008	1	42	152	36	81	8	321	382	611	382
2009	2	76	140	34	47	8	306	362	580	362
2010	7	30	133	31	63	8	271	295	472	287
2011	5	22	88	12	50	6	183	300	479	294
2012	4	105	77	10	55	7	258	293	467	286
2013	4	129	84	11	47	7	282	303	487	296
2014	5	33	64	8	47	7	164	274	438	267
2015	4	33	70	9	57	8	181	225	361	217
2016	4	34	79	10	51	7	186	231	364	224
2017	5	32	94	12	54	7	204	227	357	220
2018	6	51	80	10	53	7	207	250	394	243
2019	10	45	89	11	59	7	221	261	411	254
2020 ^e	6	0	99	12	5	7	129	238	375	231
2021 ^{a,c}	6	0	90	12	6	7	121	257	405	250
2022	-	-	-	-	-	-	-	268	422	261

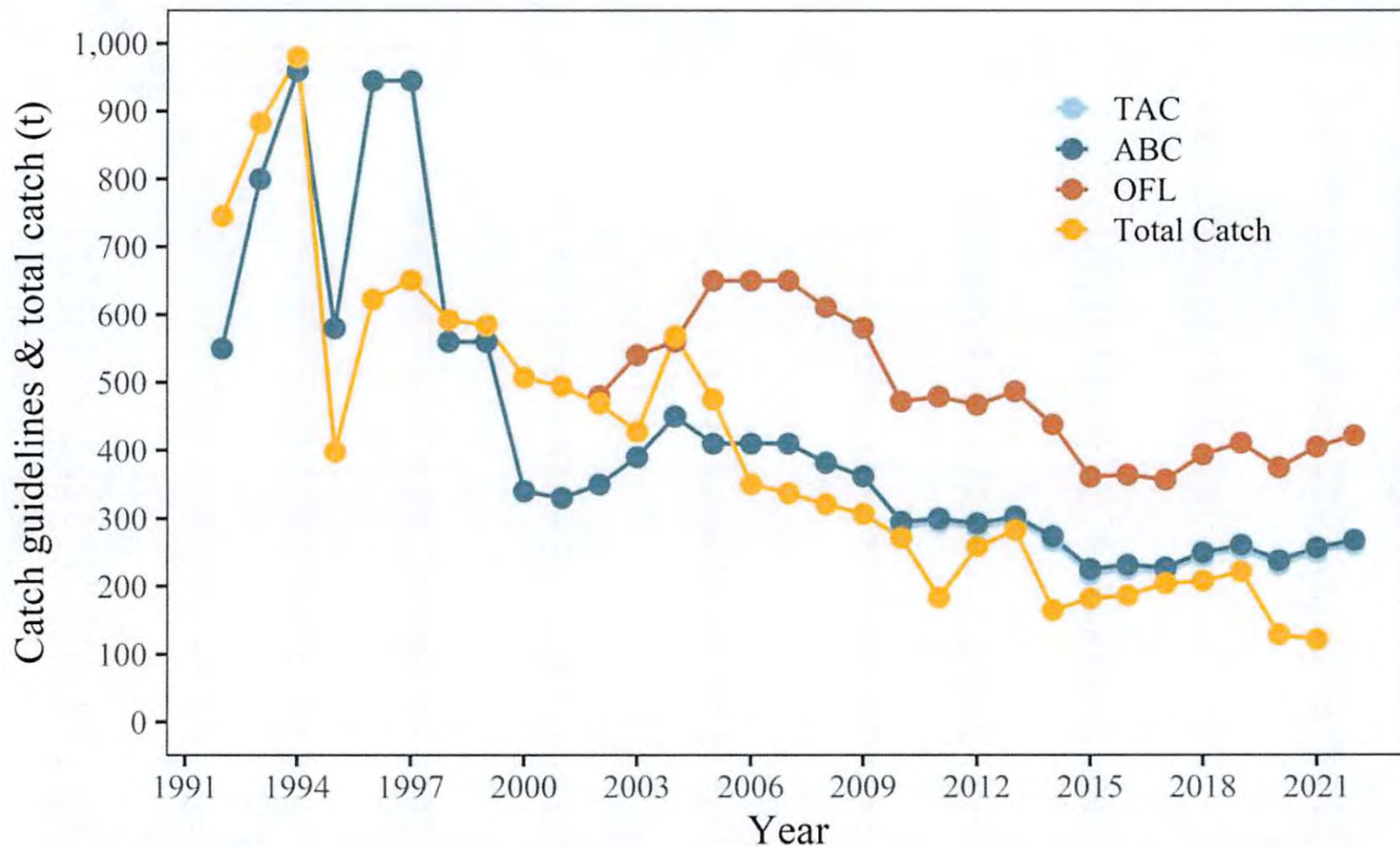
^a Landings from ADF&G fish ticket database, updated through October 26, 2021.

^b Recreational harvest for 1992–1998 referenced from Table 1 in Chadwick et al. 2017; recreational harvest for 1999–2021 include retained harvest plus estimated release mortality discard.

^c Projected subsistence catch for the fishery year. These data were not available or deducted from the ABC prior to 2009. Harvest interviews have not been conducted since 2015 but were estimated for all years to account for subsistence harvest that occurred.

^d ABC for CSEO, NSEO, and SSEO only (not EYKT) in 1993. ABC, OFL, and TAC based on lower 90% confidence interval.

^e The directed commercial demersal shelf rockfish fishery was closed to harvest in SEO.



Demersal shelf rockfish (DSR) catch guidelines: overfishing level (OFL), allowable biological catch (ABC), total allowable catch (TAC), and total catch for the Southeast Outside (SEO) Subdistrict, 1992–2022. The directed commercial fishery was closed in SEO in 2006, 2007, 2020, and 2021. The recreational fishery was closed to the retention of DSR in all Southeast Alaska management areas in 2020 and 2021; however, 2020 and 2021 recreational fishery catch include the estimated release mortality.

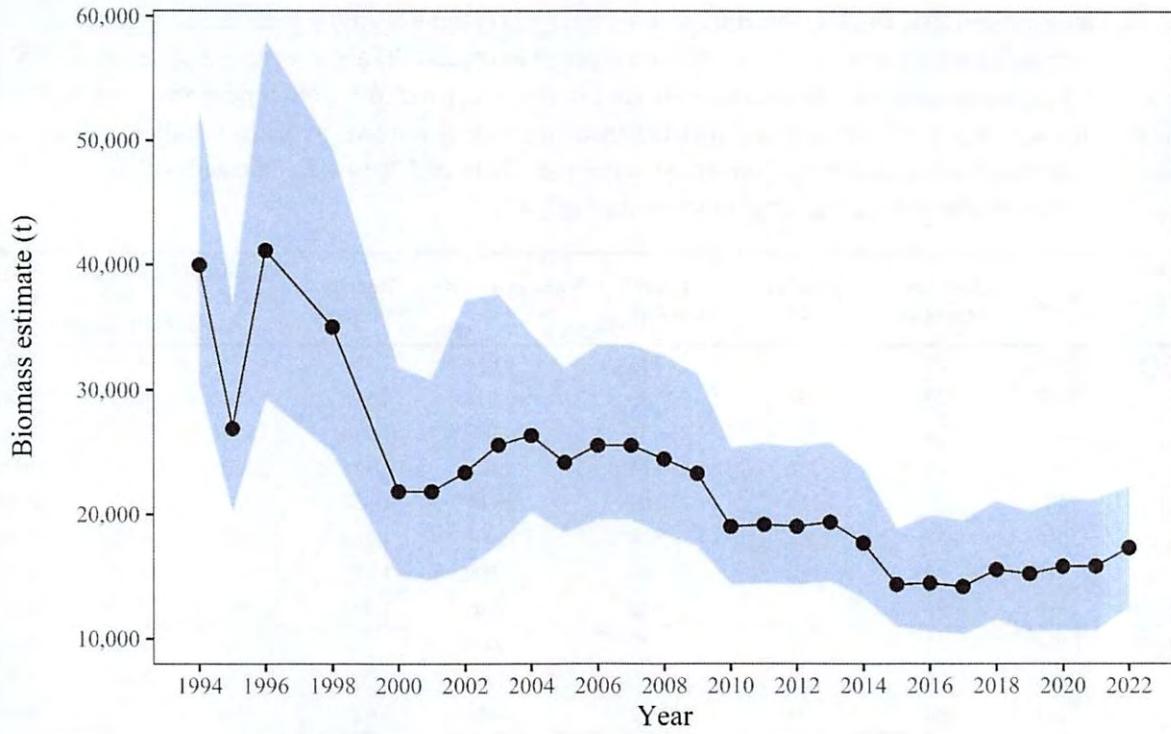
Submersible (1994–1995, 1997, 1999, 2003, 2005, 2007, 2009) and ROV (2012–2013, 2015–2020) yelloweye rockfish density estimates with 95% confidence intervals (CI) and coefficient of variation (CV) by year and management area. The number of transects, yelloweye rockfish (YE), and meters surveyed included in each model are shown, along with the encounter rate of yelloweye rockfish. Values in bold were used for this stock assessment. Density estimates from 2018 and 2019 were updated with new estimates this year due to a coding error found in the analyses.

Area	Year	Number transects	Number YE ^b	Meters surveyed	Encounter rate (YE/m)	Density (YE/km ²)	Lower CI (YE/km ²)	Upper CI (YE/km ²)	CV
EYKT ^a	1995	17	330	22,896	0.014	2,711	1,776	4,141	0.20
	1997	20	350	19,240	0.018	2,576	1,459	4,549	0.28
	1999	20	236	25,198	0.009	1,584	1,092	2,298	0.18
	2003	20	335	17,878	0.019	3,825	2,702	5,415	0.17
	2009	37	215	29,890	0.007	1,930	1,389	2,682	0.17
	2015	33	251	22,896	0.008	1,755	1,065	2,891	0.25
	2017	35	134	33,960	0.004	1,072	703	1,635	0.21
	2019	33	288	33,653	0.009	1,397	850	2,286	0.27
NSEO	1994 ^c	13	62	17,622	0.004	765	383	1,527	0.33
	2016	36	125	34,435	0.004	701	476	1,033	0.20
	2018	30	95	29,792	0.003	637	395	969	0.59
CSEO	1994 ^c	-	-	-	-	1,683	-	-	0.10
	1995	24	235	39,368	0.006	2,929	-	-	0.19
	1997	32	260	29,273	0.009	1,631	1,224	2,173	0.14
	2003	101	726	91,285	0.008	1,853	1,516	2,264	0.10
	2007	60	301	55,640	0.005	1,050	830	1,327	0.12
	2012	46	118	38,590	0.003	752	586	966	0.13
	2016	32	160	30,726	0.005	1,101	833	1,454	0.14
	2018	35	193	33,700	0.006	910	675	1,216	0.14
SSEO	1994 ^c	13	99	18,991	0.005	1,173	-	-	0.29
	1999	41	360	41,333	0.009	2,376	1,615	3,494	0.20
	2005	32	276	28,931	0.010	2,357	1,634	3,401	0.18
	2013	31	118	30,439	0.004	986	641	1,517	0.22
	2018	32	345	31,073	0.011	1,582	1,013	2,439	0.20
	2020	33	349	32,828	0.011	1,949	1,459	2,604	0.15

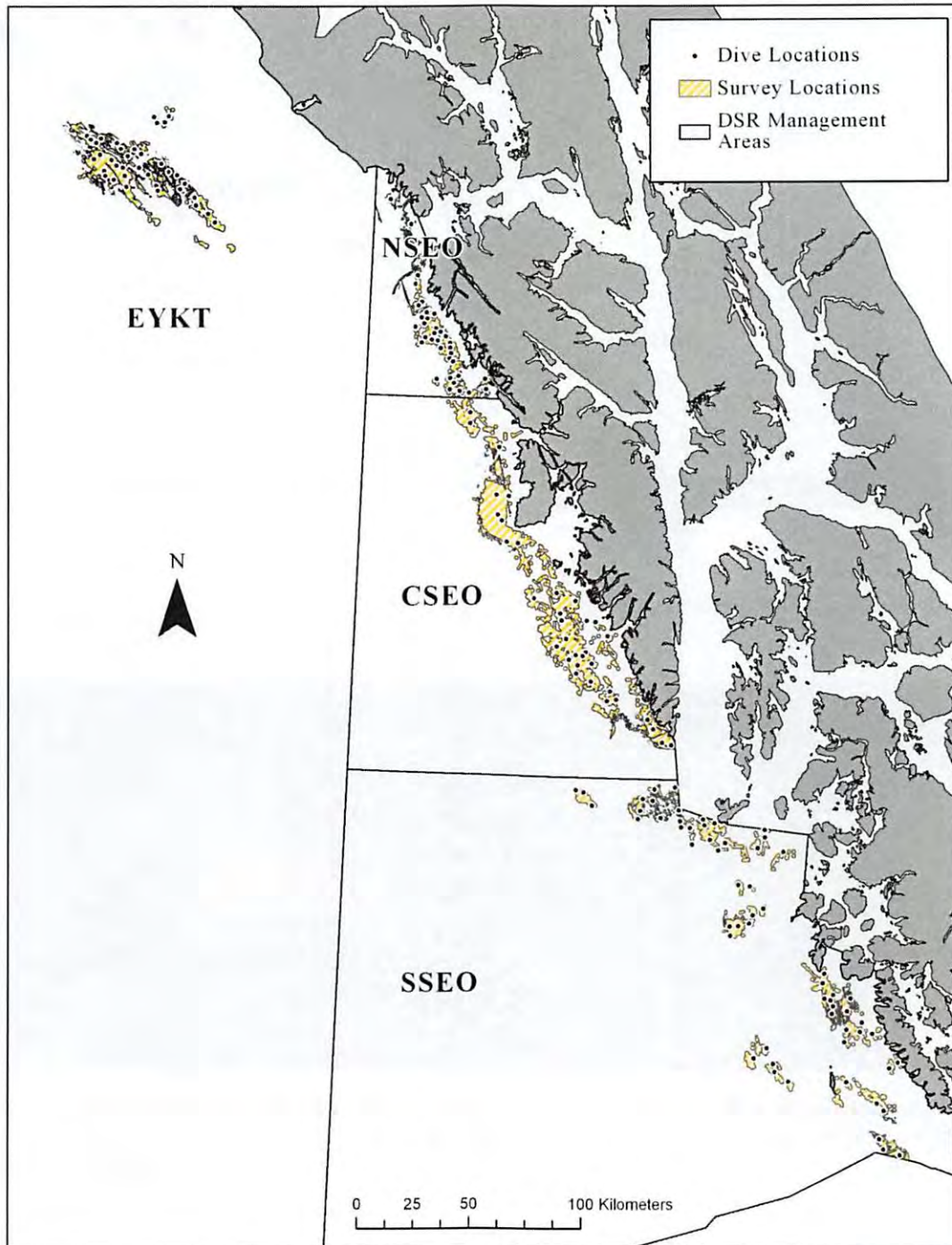
^a Estimates for EYKT management area include only the Fairweather grounds, which is composed of a west and an east bank. In 1997, only 2 of 20 transects - and in 1999, no transects - were performed on the east bank that were used in the model. In other years, transects performed on both the east and west bank were used in the model.

^b Subadult and adult yelloweye rockfish were included in the analyses to estimate density. A few small subadult yelloweye rockfish were excluded from the 2012 and 2015 models based on size; length data were only available for the ROV surveys (not submersible surveys). Data were truncated at large distances for some models; as a consequence, the number of yelloweye rockfish included in the model does not necessarily equal the total number of yelloweye rockfish observed on the transects.

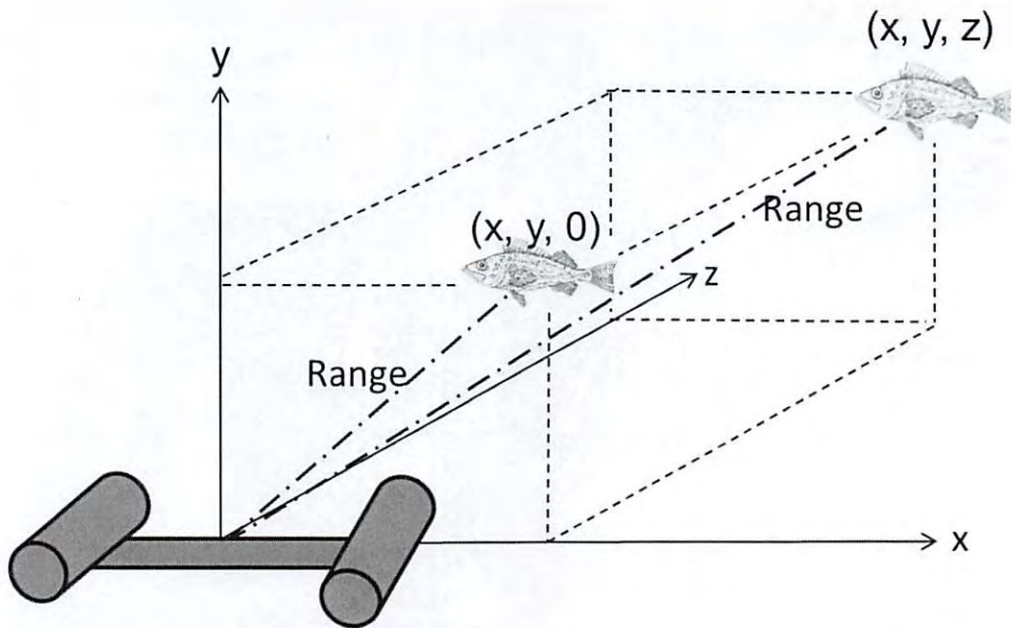
^c Only a side-facing camera was used in 1994 and earlier years to video record fish. The forward-facing camera was added after 1994, which ensures that fish are observed on the transect line.



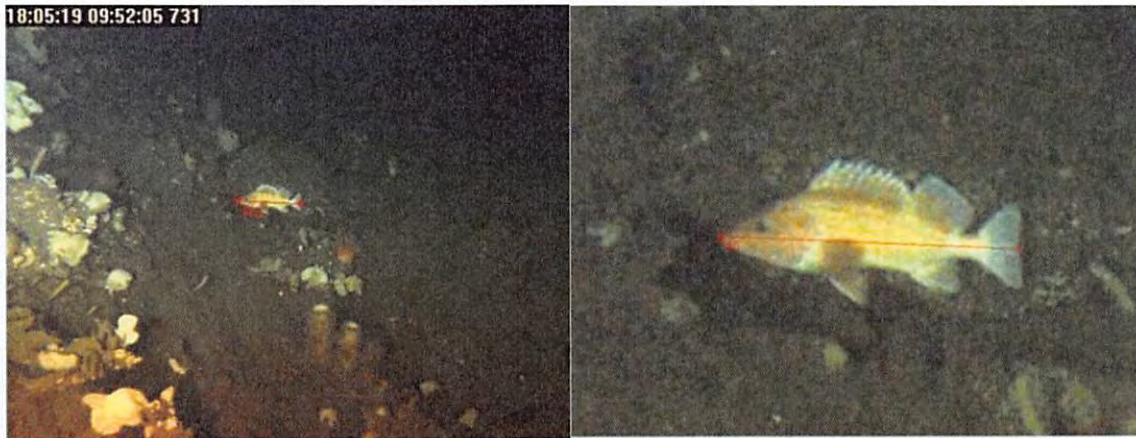
Yelloweye rockfish biomass estimate (t) (solid line) and 90% lower and upper confidence intervals (blue shaded area) for the Southeast Outside (SEO) Subdistrict, 1994–2022.



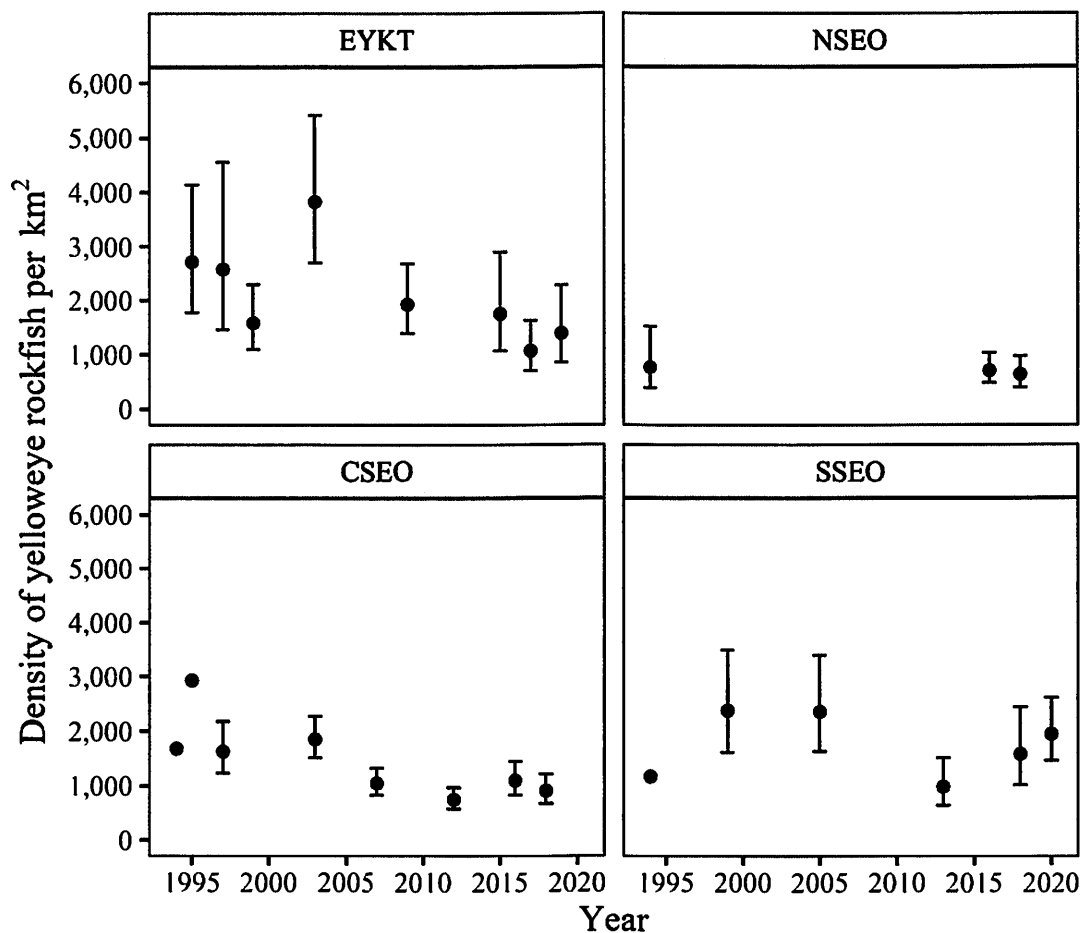
Example dive locations (black circles) within survey locations (yellow hatching) for remote operated vehicle (ROV) surveys in Southeast Outside (SEO) Subdistrict.



The components of a 3D point measurement.



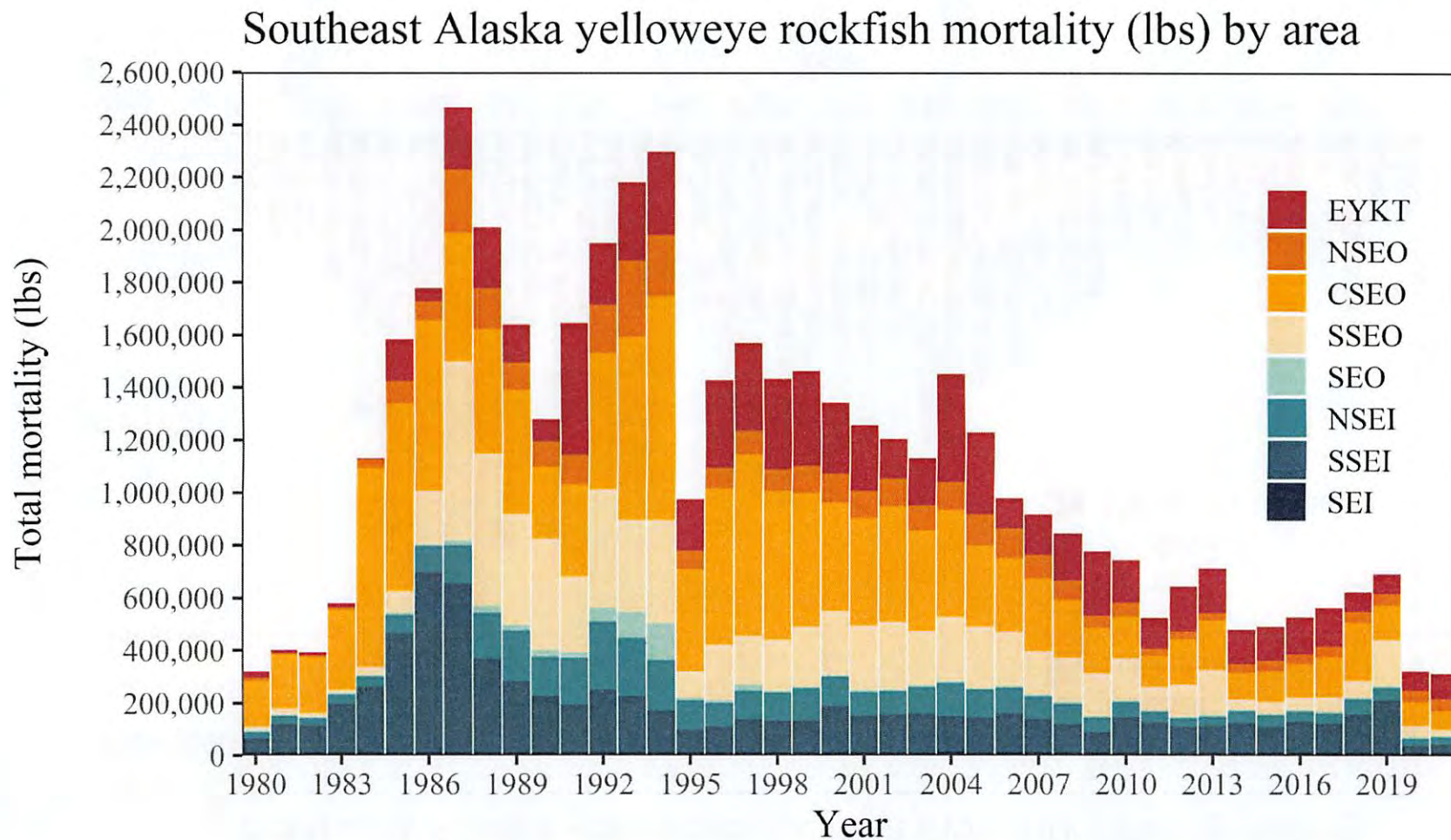
Yelloweye rockfish with a 3D point (red circle) and a total length (red line) measured in the stereo camera overlapping field of view in the SeaGIS EventMeasure software.



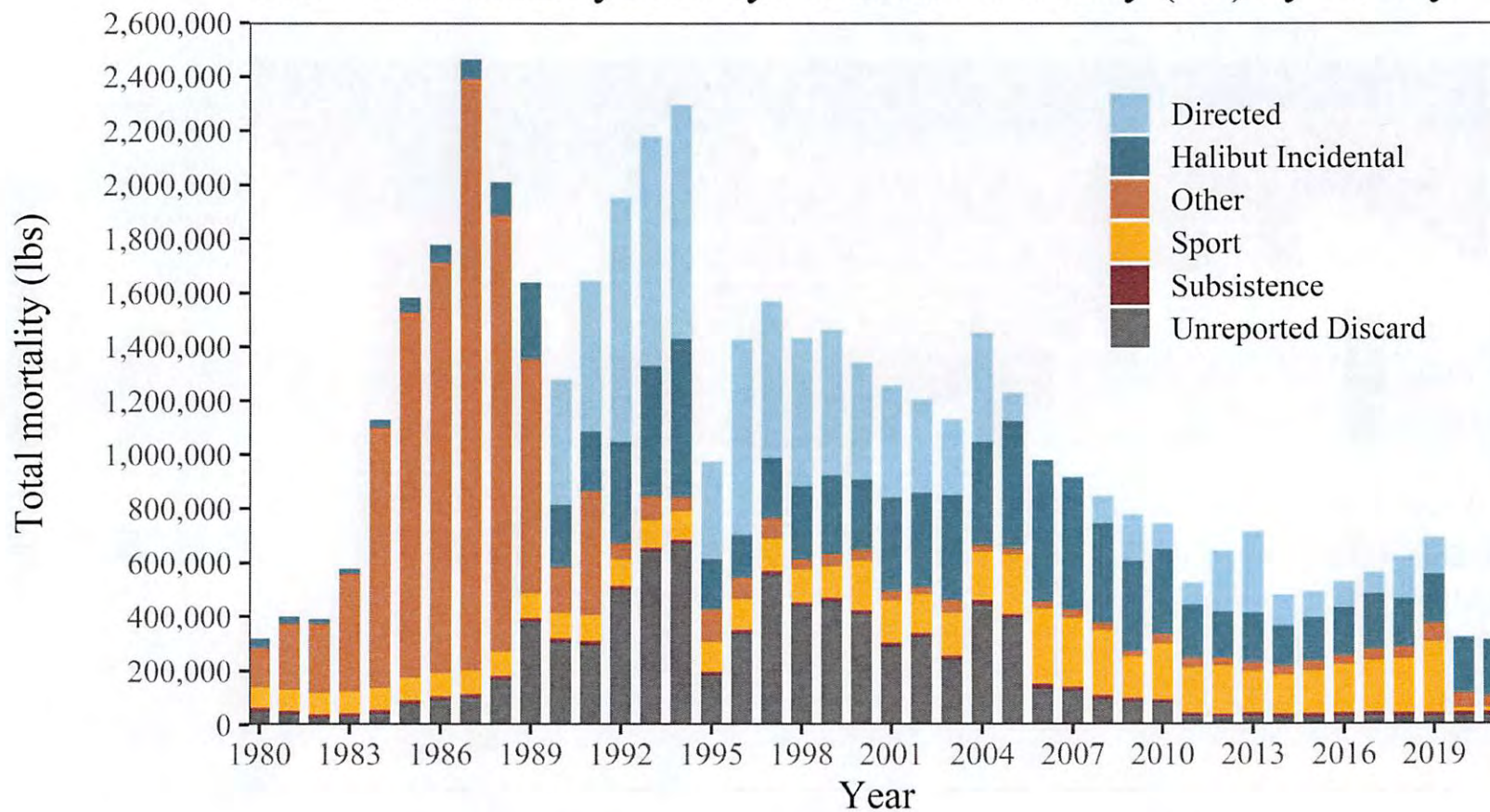
Density of yelloweye rockfish predicted by DISTANCE (circles) +/- two standard deviations in each management area: East Yakutat (EYKT), Northern Southeast Outside (NSEO), Central Southeast Outside (CSEO), and Southern Southeast Outside (SSEO) Sections, 1994–2020.

**Southeast Outside and Inside
Waters Yelloweye Rockfish
Harvest Figures**

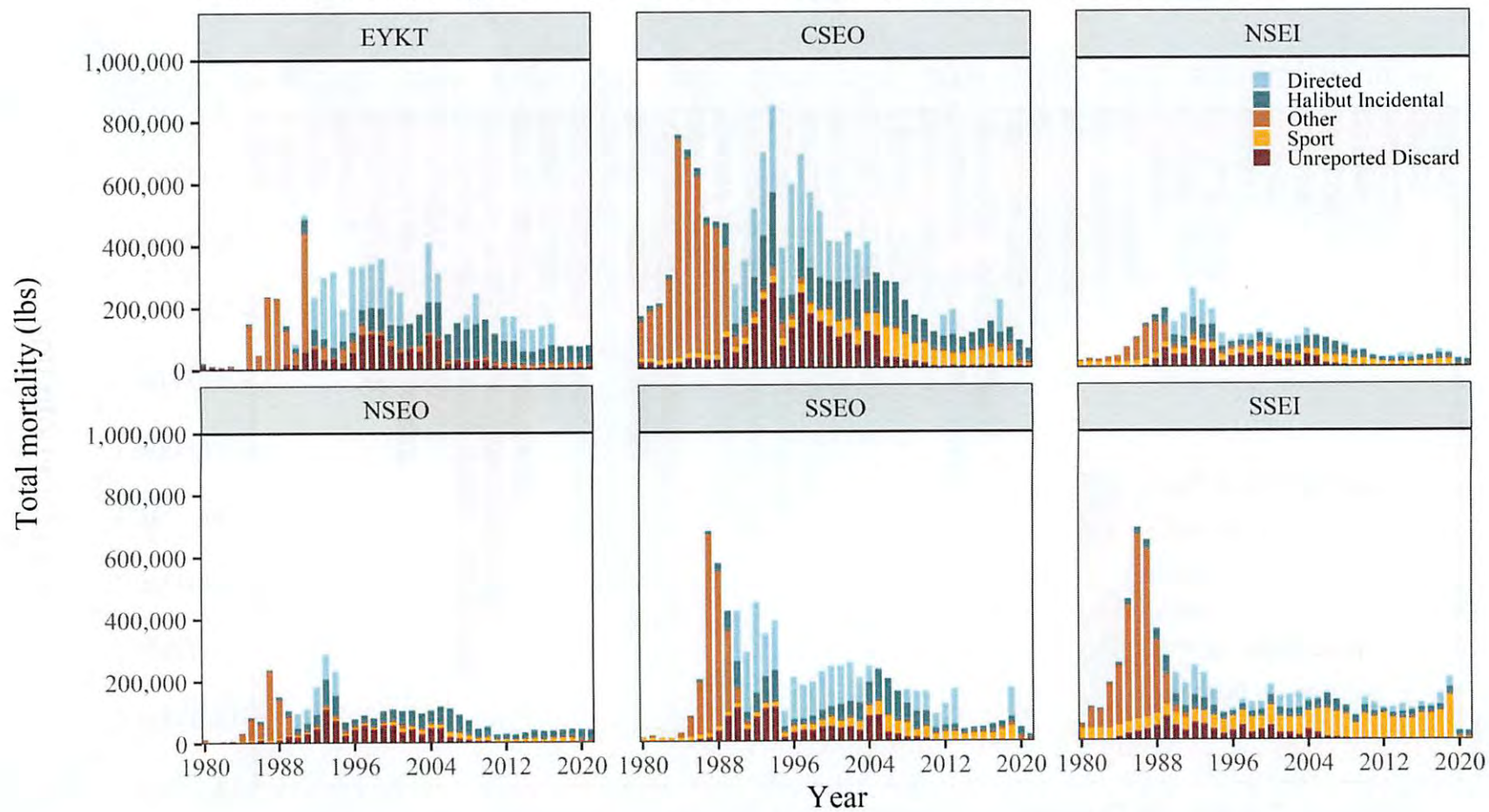
All Southeast (Outside and Inside combined) – Yelloweye rockfish mortality estimates



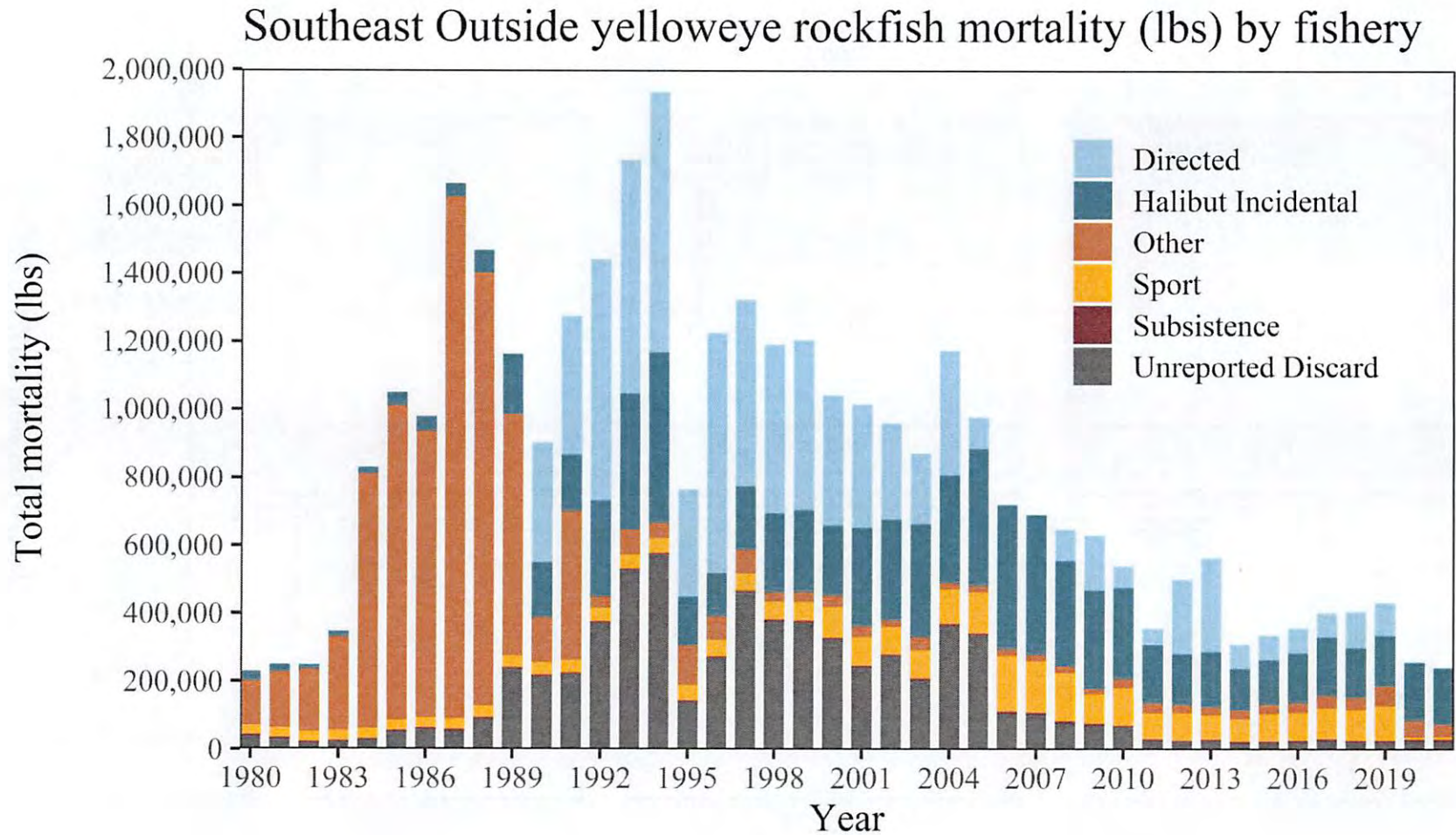
Southeast Alaska yelloweye rockfish mortality (lbs) by fishery



Southeast Alaska yelloweye rockfish mortality (lbs) by fishery and area

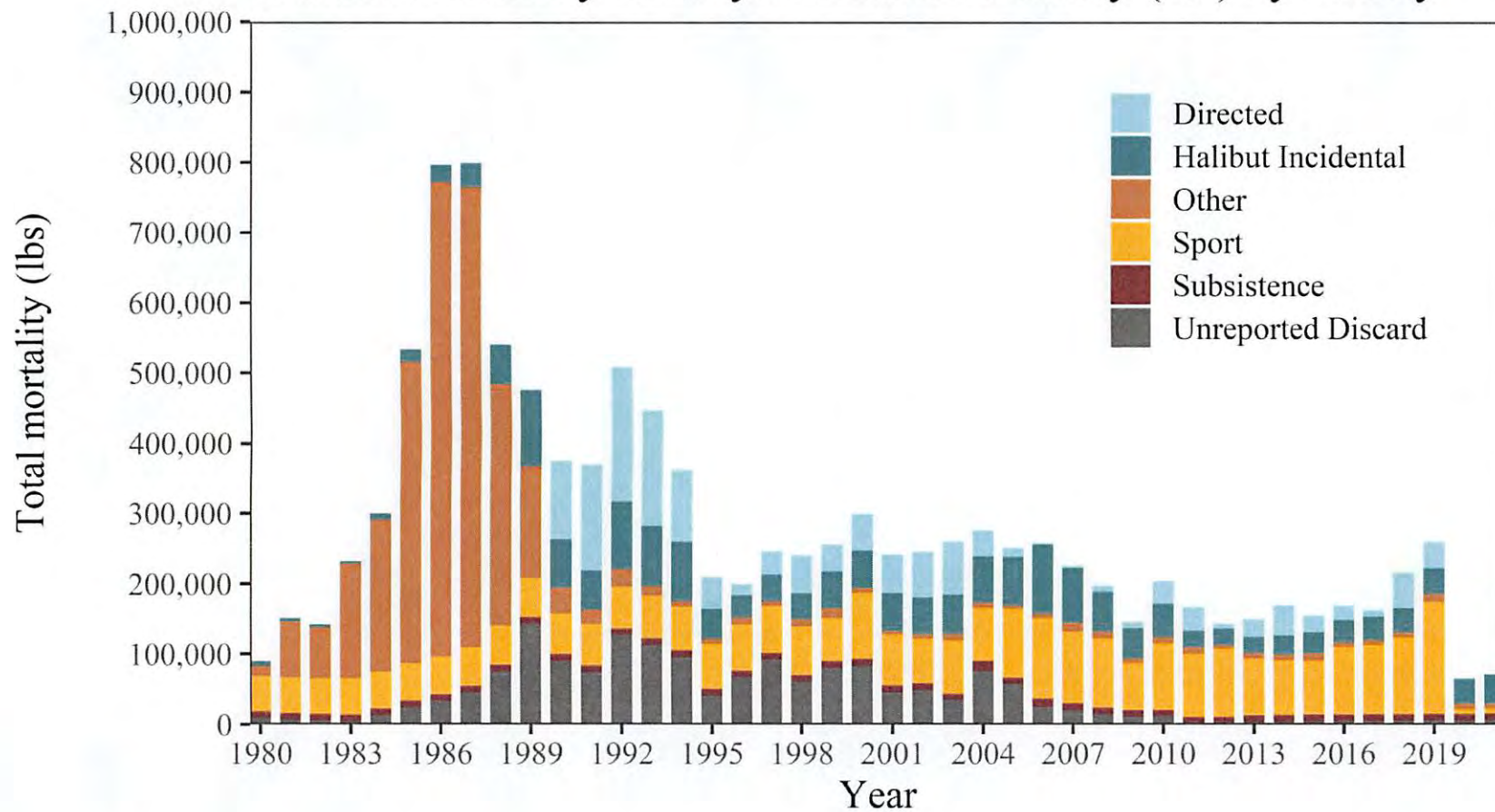


Southeast Outside waters only – Yelloweye rockfish mortality estimates



Southeast Inside waters only – Yelloweye rockfish mortality estimates

Southeast Inside yelloweye rockfish mortality (lbs) by fishery



80-84