Text S1. *Data Formatting and Processing*

S1.1. *Recaptures*

In the 1960s and 1990s, the disposition of reencountered fish (e.g., kept or released) was not always provided. Unless otherwise reported, we assumed all sublegal fish recaptured by anglers were released and all legal-size fish were retained (but see section 2.2.3 in the Methods). During the 1960s, 1990s, and through February 2013, the minimum size limit (MSL) was 305 mm (12 in total length [TL]), corresponding to a fishery recruitment age of five to six years (Love et al. 1996a); afterward the MSL increased to 356 mm (14 in TL, Jarvis et al. 2014), corresponding to fishery recruitment at approximately eight years (Walker et al. 2020). We removed records with unknown tagging lengths from the analysis.

We assumed a reencountered fish was recaptured by a biologist if the recapture occurred on the same date and at the same location as a survey occasion *and* the recapture length was not missing. We estimated missing dates based on time at liberty (in years) calculated from the difference in age between tag and recapture events using published von Bertalanffy age and growth parameters from the 1990s (Love et al. 1996a). If a tagging date was missing and there was also a missing recapture length, the tagging date was deduced based on sampling dates at the tag location and the sequence of tag identification numbers at that location.

We identified outliers in the reported lengths of recaptured Barred Sand Bass *Paralabrax nebulifer* (BSB) by first calculating growth increments of recaptured fish and standardizing them by time at liberty in years (mm yr^{-1}). We then examined the distributions of growth increments over fish lengths in 50 mm TL bins from 250 – 600 mm. Of the reported recapture lengths (Table S1), we flagged negative growth and increments greater than 150 cm in a year as outliers (1960s: n = 5, 1990s: 34, 2010s: NA) and coded the corresponding reported recapture lengths as 'NA' (not available).

S1.2. *Assignment of Recovery Occasions*

In the 1960s and 1990s data, if a fish was tagged the year prior and caught and kept the following year, but before the next survey occasion (e.g., Jan-May), then the fish did not survive the interval from t to t+1, and we recorded the recovery observation as occurring in that same year (t+1). However, if a fish was tagged the year prior and caught and kept the following year during or after the following survey occasion, i.e., Jun-Dec, then the fish survived the interval from t to t+1 and we recorded the recovery observation as occurring in the subsequent year, t+2. Thus, we pushed recovery occasions out by one occasion unless the fish was recovered before June. In the 2010s data, we pushed all recovery occasions out by one occasion since the non-survey interval was sufficiently short (less than one month).

Text S2. *Tag Retention Model*

We used a Bayesian state-space framework in JAGS (Su & Yajima 2021, Plummer et al. 2022) and Kelp Bass *P. clathratus* double-tagging data (Bellquist 2015) to model BSB tag retention over time, as a function of age of tag:

$$Q_i = \alpha * \exp\text{-}(\beta * t^{\gamma}), \text{ where,}$$

Q_i is the fish-specific probability of retaining a tag after recapture interval t,

α is the probability of retaining a tag immediately after release,

β is the continuous rate of long-term (chronic) tag loss (note that $\exp(-\beta)$ is the discrete rate of retention in a single time step),

t is the time at liberty, and

γ is an exponent on time to account for age of tag.

The model accounts for the probability of a fish retaining both tags or just one tag, where,

$p_1 = (1 - Q_i) * Q_i + Q_i * (1 - Q_i)$ is the probability of retaining the first tag and losing the second tag or losing the first tag and retaining the second tag, and

$p_2 = 1 - p_1$ is the probability of retaining both tags.

The likelihood of the data was then drawn from a binomial distribution of one trial with probability equal to p_2. We first derived posterior estimates of the cumulative tag retention (Q_t) over time from one to ten years at liberty (the maximum number of survey occasions). This represented the mean proportion of fish in the double-tagging study still retaining at least one tag at each time step. We then solved for the mean time-dependent probabilities of retaining a tag with the following equation:

$$tr_t = 1\text{-} (Q_{t-1} - Q_t)/Q_{t-1}, \text{ where,}$$

Q_{t-1} is the proportion of fish still retaining at least one tag at time $t-1$, and

Q_t is the proportion of fish still retaining at least one tag at time t.

Text S3. *Growth Model*

We used the Francis parameterization of the von Bertalanffy growth function (VFGF) in the R package FSA (Ogle et al. 2022) and BSB age and growth data from Walker et al. (2020) to estimate BSB growth parameters,

$$E[L|t] = L1 + (L3 - L1)\frac{1 - r^{2\frac{t-t_1}{t_3-t_1}}}{1 - r^2}, \text{ where,}$$

E[$L|t$] represents the estimated length at age,

$L1$, $L2$, and $L3$ are the mean lengths at ages t_1, t_2, and t_3,

t_1 and t_3 are not estimated but are assigned to correspond to "young" and "old" ages, respectively,

$t_2 = t_1+t_3 / 2$, and

$r = L3 - L2 / L2 - L1$.

We used the length parameter estimates generated from the Francis parameterization of the VBGF to define the priors in our capture-mark-reencounter (CMR) models (Table S1). For the 1960s and 1990s, we used length parameter estimates based on $t_1 = 3$ years and $t_3 = 16$ years. In the 2010s model, we modeled monthly growth, and thus, length priors were based on the age of fish in months: $t_1 = 24$ months and $t_3 = 192$ months (Table S1). We chose a smaller age at t_1 for the 2010s model because the minimum size tagged was smaller than in the 1960s and 1990s.

Text S4. *Size-specific Estimates of Annual Harvest*

Harvest includes fish caught and kept by Commercial Passenger Fishing Vessels (CPFVs), private boaters, and shore anglers. We obtained harvest in numbers from California Department of Fish and Wildlife (CDFW) CPFV logbooks between 1947 and 2021. Harvest for BSB prior to 1975 was likely underreported because although catches of "sand bass" could be recorded in catch logs, Kelp Bass was the only *Paralabrax* species that was pre-printed on the logs for entering catch, and captains were not required to distinguish the bass species in their records (Croker 1940, Young 1969). Historically, CDFW biologists estimated BSB comprised a small portion of the bass catch through the 1950s (~25%, Clark 1933, Roedel 1953, Young 1969), but this increased to ~50% by at least the mid-1960s (Pinkas et al. 1968) and returned to 25% by at least the mid-1970s. We applied these percentages to the overall numbers of harvested bass (historically referred to as "Rockbass") reported in the logbooks to calculate estimated annual BSB CPFV catches prior to 1975.

Estimates of private boat and shore-based harvest from the 1960s were only available from 1964-65 (July-June, private boat) and 1965 (January-December, shore-based, Pinkas et al. 1968, Table S2). Thus, for the 1960s we have a single estimate of BSB harvest, in which the CPFV estimate from 1964 and the estimated private boat and shoreline catch were combined. For the other two decades, given that the CPFV logbook data is the longest running record of recreational bass harvest, we chose to account for other methods of BSB take by adjusting the annual BSB CPFV harvest. To do so, we added numbers equivalent to the proportion of private and shore-based BSB harvest in each year, according to the relative proportion of harvest by fishing modes available from southern California recreational survey estimates, which are based on angler-intercept and telephone surveys (1980-2003: Marine Fisheries Statistical Survey [MRFSS], 2005-2017: California Recreational Fisheries Survey [CRFS], Table S2, data available from www.recfin.org). Thus, the adjusted BSB harvest, which represents the total estimated harvest of BSB, was then comparable across years.

For each year of available harvest, we estimated the proportion of sublegal and legal-size fish harvested. For 1964, we multiplied BSB harvest by the proportion of sublegal and legal-size harvested BSB measured in recreational angler-intercept surveys by CDFW biologists in the year 1975 (Wine 1978), as this was the earliest year for which length data in the recreational harvest was available (Table S2). For the 1990s and 2010s, the annual harvest was split into sublegal and legal size by multiplying the total annual harvest by the relative annual proportions of both size classes obtained from recreational angler surveys (Table S2). We applied these size-specific estimates of annual harvest (sublegal and legal) to CMR model estimates of exploitation to derive size-specific estimates of population size during each tagging period (see sections 2.3.1 and 2.3.2 in the main text).

Text S5. *Search Terms for Historical Literature Review*

We conducted our historical literature review on the Web of Science search engine, as well as with Google Scholar. Search terms included "Barred Sand Bass," "Sand Bass," "Sandbass," "*Paralabrax nebulifer*," "rockbass," and "rock bass."

Text S6. *Detailed Narrative of Historical BSB Accounts*

Between the 1850s and 1970s there were three extended warm periods in southern California, USA; the first warm period was from 1854 to 1870, the second was from about 1925 to 1947, and the third was from 1977 to 1998 (Fig. S4, Hubbs 1948, McClatchie 2014). However, the second warm period was only moderately warm (McClatchie 2014). BSB was first taxonomically described in 1854 during the first warm period, when the southern California fish fauna was described as "tropical" and BSB was first described as far north as Monterey, CA (Fig. S4-a, Girard 1858, Hubbs 1948). In the early 20th century, "Rock Bass" is noted in an iconic fishing guide as being a "nuisance" to recreational anglers fishing for Yellowtail *Seriola dorsalis* and White Sea Bass *Actractoscion nobilis* (Holder 1912, Fig. S4-b), but given the inferred habitat, the author may have been simply referring to Kelp Bass. A description of the basses from the late 1910s report BSB as "rather abundant" in coastal southern California, and by the 1920s, BSB is noted as a minor contribution to California's early commercial fishery for Rockbass (Fig. S4-c,d). During the moderately warm period (1925-1947), CDFW biologists estimated the commercial Rockbass harvest consisted of 25% BSB and 75% Kelp Bass (Clark 1933). Most commercial Rockbass were incidentally taken when fishing for other species, i.e., rockfish *Sebastes* spp., California Sheephead *Semicossyphus pulcher*; by weight, recreational Rockbass harvest was three times higher than commercial Rockbass harvest (Collyer 1949).

Between 1920 and 1939, CPFV fishing became more affordable and by 1936, a catch logbook was required to be submitted (Croker 1940). Shortly after, in 1939, a bag limit for the three saltwater basses of 15 fish in aggregate was implemented (Fig. S4-1, Jarvis et al. 2014). The early description of the combined CPFV bass harvest was "mostly" Kelp Bass, with "some" BSB (Croker 1940, Fig. S4-e). During the warmest part of the moderately warm period in the mid-1940s, there was a five-year reprieve from CPFV fishing due to World War II, and thus, no catch records exist (Fig. S4, Young 1969). Following the war, the oceanographic climate shifted to a cold regime, during which BSB were reportedly "scarce" and comprised a "very small portion of the catch" (Fig. S4-f, Young 1963, Young 1969). In the 1950s, a series of sportfishing regulations were implemented for the basses due to concerns over the Kelp Bass resource and declining catches (Fig. S4-2,3, Jarvis et al. 2014).

In 1962, CDFW field biologists noted "tremendous" numbers of BSB in southern California waters and initiated the BSB tagging study from which our model results are drawn (Fig. S4-g, CDFG 1962). This apparent dramatic increase in BSB availability was also referenced in Young (1969), Frey (1971), and Feder et al. (1974), and was reflected in the substantial increase in Rockbass harvest during the 1960s (Fig. S4-g). The 1962 increase in availability occurred 5-6 y after the significant 1957/58 El Niño event (Radovich 1961, Fig. S4-g), corresponding to the age when fish recruited into the fishery. It was also during the early 1960s that underwater observations of BSB spawning aggregations were first documented (Turner et al. 1969). Additionally, CDFW field biologists referred to BSB as "a more southern species frequenting our coast in and subsequent to periods of warmer waters," and "Recently, 1960 to 1970, barred sand bass have formed an important part of the sport catch." (Fig. S4-g, Feder et al. 1974).

Following the increase in Rockbass harvest during the 1960s, the Rockbass bag limit was increased in 1972 from 15 fish in combination with not more than ten of any one species, to 20 fish in combination with not more than ten of any one species (Fig. S4-4). Nevertheless, a year earlier, when reporting on the status of the BSB population, CDFW resource managers foreshadowed a decrease in BSB availability in southern California, "One cloud on the horizon—barred sand bass have not always been present in large numbers in southern California." (Fig. S4-h, Frey 1971). Shortly thereafter, by 1975, harvest declined dramatically and the Rockbass bag limit was reduced by half to ten fish in combination. By the mid-to-late 1970s, Rockbass harvest returned to being dominated by Kelp Bass, and BSB CPFV CPUE was calculated to be 5-10x lower than was later observed in the 1980s during the subsequent warm regime (Fig. S4-i, Love et al. 1996b).

Table S1. Prior parameter distributions used in the Bayesian capture-mark-reencounter models for Barred Sand Bass *Paralabrax nebulifer* tagged over three decades in southern California, USA. yal = years at liberty.

Model	Parameter	θ	Distribution
1960s and 1990s	true survival	ϕ	beta(1,1)
	biologist recapture probability	p	beta(1,1)*
	angler recovery probability	κ	beta(1,1)
	angler resighting probability	R	beta(1,1)*
	mean length at age 3 y	$L1$	normal(236,10)
	mean length at age 9.5 y	$L2$	normal(403,10)
	mean length at age 16 y	$L3$	normal(495,10)
	probability tag retained after 1 yal	tr_1	beta(1120,162)
	probability tag retained after 2 yal	tr_2	beta(72,23)
	probability tag retained after 3 yal	tr_3	beta(11,7)
	probability tag retained after 4 yal	tr_4	beta(6,6)
	probability tag retained after 5 yal	tr_5	beta(5,6)
	probability tag retained after 6 yal	tr_6	beta(4,6)
	probability tag retained after 7 yal	tr_7	beta(4,6)
	probability tag retained after 8 yal	tr_8	beta(3,6)
	probability tag retained after 9 yal	tr_9	beta(3,6)
	probability tag retained after 10 yal	tr_{10}	beta(3,6)
	probability tag retained after 11 yal	tr_{11}	beta(3,6)
2010s	true survival	ϕ	beta(1,1)
	biologist recapture probability	p	beta(1,1)
	angler recovery probability	κ	beta(1,1)
	angler resighting probability	R	beta(1,1)
	mean length at age 24 mos	$L1$	normal(191,100)
	mean length at age 108 mos	$L2$	normal(391,100)
	mean length at age 192 mos	$L3$	normal(487,100)
	annual tag retention rate	r	beta(140,27)

*This parameter fixed at zero in the 1990s mark-resight-recovery model.

Table S2. Compilation of Barred Sand Bass *Paralabrax nebulifer* (BSB) southern California, USA, harvest statistics used in calculating the estimated mean annual numbers of legal- and sublegal-size fish harvested in the fishery during each tagging period. Prop. = proportion, CPFV = Commercial Passenger Fishing Vessel.

		Angler-intercept/Phone Survey Estimates[a]						
Decade	Year	Prop. Legal Size	Total observed (measured)	Shore-based	Party/Charter Boats	Private/Rental Boats	Total BSB Harvest (all fishing modes)	CPFV BSB Harvest
1960s[b]	1964	0.85[c]	5,562[c]	7,318[b]	no estimate	64,513[b]	610,831	539,000[d]
				Prop. of Total				
	1989	0.98	1,636	--	0.59	0.40	1,295,773	787,074
	1993	0.97	2,086	0.00	0.56	0.43	731,182	309,000
	1994	0.97	1,393	0.03	0.54	0.43	703,763	270,000
1990s[e]	1995	0.97	--	0.02	0.64	0.34	801,512	349,000
	1996	0.97	1,948	0.01	0.68	0.32	743,805	591,000
	1997	0.98	1,062	0.02	0.41	0.57	462,973	476,000
	1998	0.98	1,460	0.01	0.37	0.62	417,633	376,000
	1999	0.98	3,925	0.00	0.44	0.56	488,743	414,000
	2013	0.91	1,031	0.05	0.62	0.34	64,796	56,000
2010s[f]	2014	0.89	1,264	0.02	0.76	0.22	69,474	39,000

[a]Harvest estimates are provided for shore-based fishing (man-made structures, beach and bank) and boat-based fishing from CPFVs (Commercial Passenger Fishing Vessels; party/charter) and privately-owned/rental boats. Estimates are derived from a combination of angler intercept surveys and phone surveys of effort.

[b]Harvest estimates from Pinkas et al. (1968). The shore-based estimates are for the 1964/1965 season (July - June). The private boat estimates are for the year 1964 (January - December). Total harvest includes the estimate for CPFV BSB harvest.

[c]Data source is for the year 1975, Wine (1978).

[d]Harvest estimates are for the year 1964 (January - December). Total bass harvested by CPFVs in 1964 was 1,078,000 fish; we applied a factor of 0.5 to this number to estimate BSB harvest; BSB comprised ~50% of the private boat harvest during this year (Pinkas et al. 1968).

[e]Survey proportions and harvest estimates obtained from the National Oceanic and Atmospheric Administration, Marine Recreational Fisheries Statistics Survey, 1980–2003.

[f]Survey proportions and harvest estimates obtained from the California Recreational Fisheries Survey, 2004–2021.

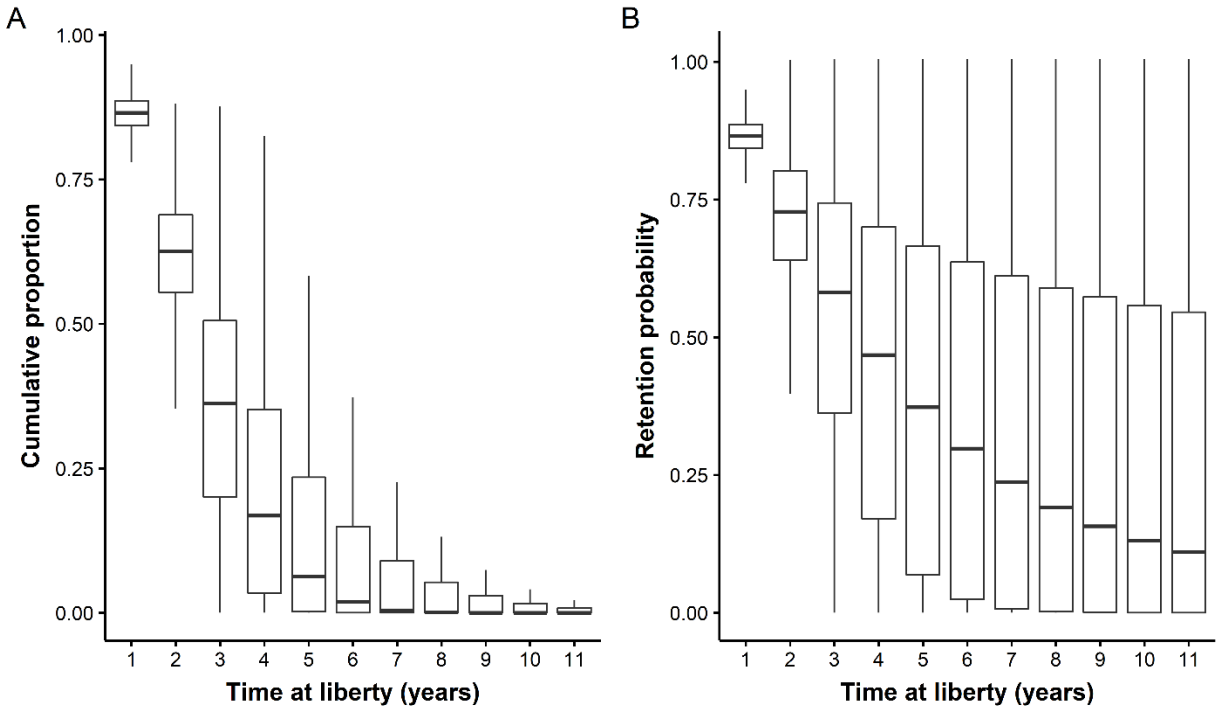

Figure S1. Box plots of Bayesian posterior estimates (mean and 95% Credible Intervals) of the a) cumulative proportion of double-tagged Kelp Bass *Paralabrax clathratus* retaining at least one tag in southern California, USA, and b) the associated time-dependent tag retention probabilities (non-cumulative) applied as tag retention priors in the Barred Sand Bass *P. nebulifer* capture-mark-reencounter models.

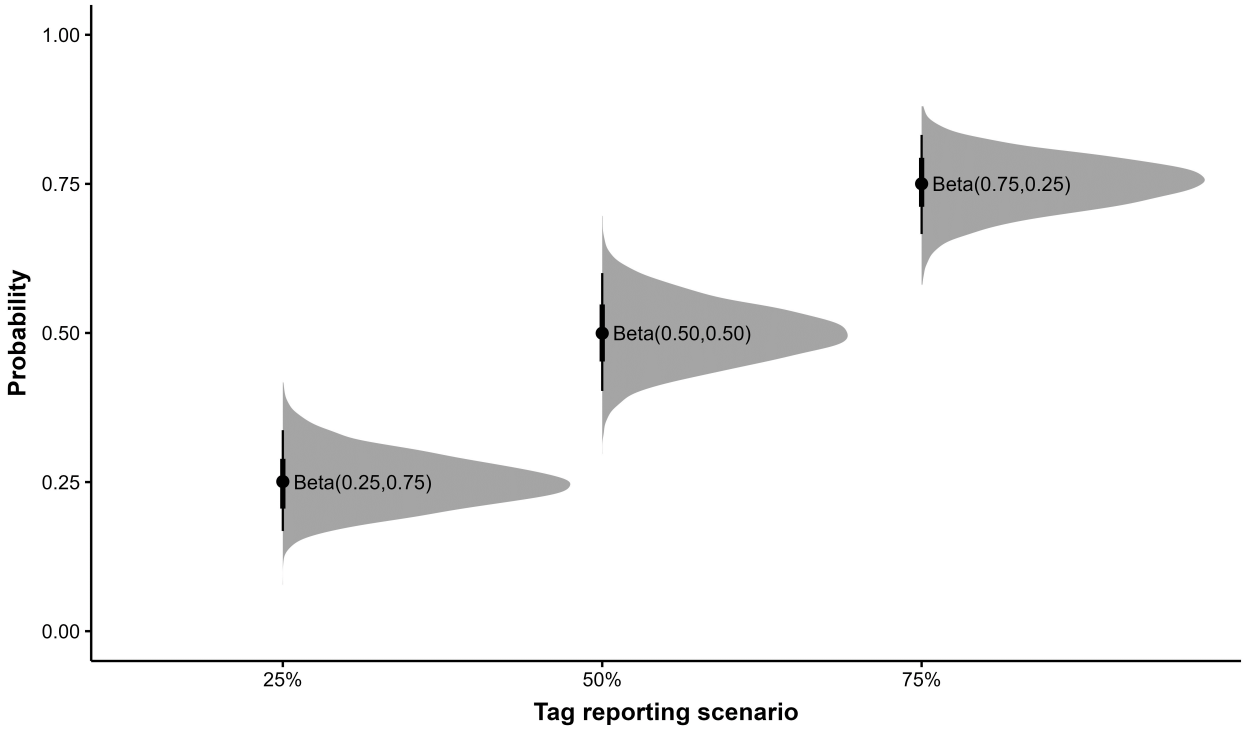

Figure S2. Bayesian prior distributions and mean and 66 and 95% Highest Density Intervals (dots plus thick and thin lines) for the tag reporting prior sensitivity analysis used to derive Barred Sand Bass *Paralabrax nebulifer* harvest rates in southern California, USA, across three hypothetical tag reporting rate scenarios. The assigned beta distributions are labeled for each scenario.

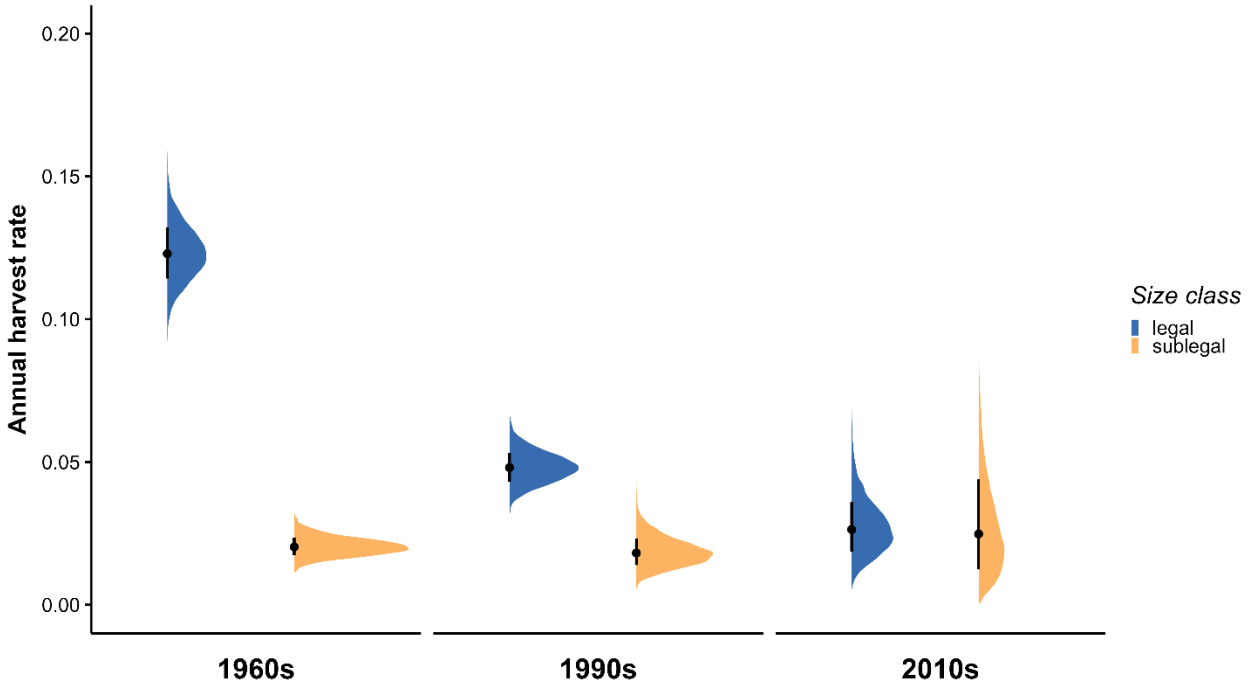

Figure S3. Bayesian capture-mark-reencounter model posterior distributions and mean annual harvest rate plus 66% Highest Density Intervals (dots plus lines) for legal- and sublegal-size Barred Sand Bass *Paralabrax nebulifer* in southern California, USA, across tagging periods. Annual harvest rate is the proportion of fish dying each year due to fishing. The estimates are conservative, as they assume a 100% tag reporting rate. See main text for decadal harvest rates conditioned on hypothetical tag reporting rates.

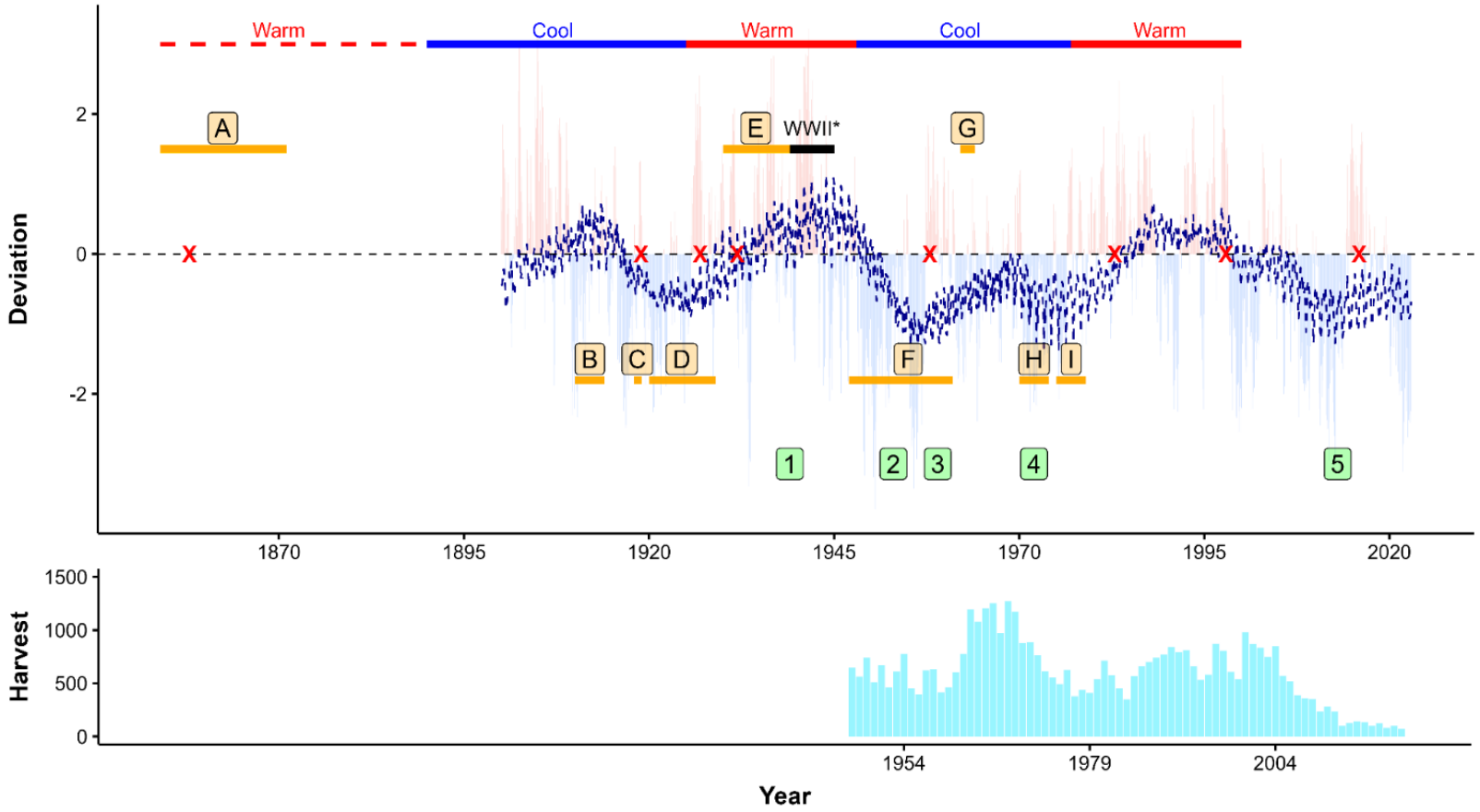

Figure S4. Graphical timeline (top) and trends in Rockbass Commercial Passenger Fishing Vessel (CPFV) harvest in thousands of fish (bottom) for contextualizing historical accounts of Barred Sand Bass *Paralabrax nebulifer* (BSB) distribution and availability in California, USA, from the mid-nineteenth century to the 2020s (reference table next page). Rockbass harvest includes BSB and Kelp Bass *P. clathratus*. The trend line represents a 12-month running average of the Pacific Decadal Oscillation, a measure of sea surface temperature anomalies); periods designated as cool and warm are based on Minobe (1997) and Mantua et al. (1997). X = El Niño resulting in either seasonal warm water intrusions of subtropical and tropical fauna or decadal-scale northern range expansions of temperate/subtropical fauna in California. *No CPFV fishing permitted for five years during World War II

Key	Period	Species account	Source
A	1854-1869	The taxonomic species description for BSB is based on two specimens collected off Monterey, CA in 1854. A subsequent publication describes the Monterey fish fauna during this period as “made up to a considerable degree of fishes now characteristic of the relatively warm waters south of Point Conception”, and “five or six kinds that do not now occur so far north or are so rare as not to be collectable by any such dribbling survey as that of the 1850's. These southern types are the sand bass, *Paralabrax nebulifer*...”. The southern California fish fauna during this period is described as tropical.	Girard 1888, Hubbs 1948
B	early 1910s	An iconic California fishing guide of the time mentions “Rock Bass” as a "nuisance“ to Yellowtail and White Sea Bass sport anglers.	Holder 1912
C	late 1910s	BSB is noted as being "rather abundant on the coast of southern California“.	Starks 1919
D	1920s	BSB is reported to be a minor component of “Rockbass” commercial harvest, comprising an estimated 25% of the total landings of Kelp Bass and BSB. Commercial harvest of Rockbass was reported to be the result of incidental catches in other fisheries targeting rockfish and California Sheephead. By weight, the annual commercial Rockbass harvest was roughly one-third of that reported in the recreational Rockbass CPFV fishery.	Clark 1933; Collyer 1949
E	1930s	The first accounting of the CPFV logbook records reports that Rockbass harvest is comprised of “mostly” Kelp Bass, with “some” BSB.	Croker 1940
	1934	In documenting fished species of Mission Bay in San Diego, CA, the authors state, "This fish is very common everywhere at all seasons and is taken by anglers in the channels of all parts of the bay. Specimens up to five pounds are to be caught. A desirable species."	Fry & Croker 1934
1,2,3	1939- 1959	1) Bag limit implemented to include all three *Paralabrax* species : 15 fish in aggregate (1939), 2) bag limit changes twice; 15 fish in aggregate (1949), 15 fish in aggregate, with not more than 10 of any one species (1951), and 3) the sale or purchase is prohibited (1953) and a minimum size limit is implemented and progressively increased from 10.5 inches in 1957 to 12 inches in 1959.	Jarvis et al. 2014
F	1947-1958	With respect to CPFV harvest, BSB is noted to comprise "a very small portion of the catch“. BSB is referred to as “scarce” from the late-1940s to the early 1960s, but especially during the 1950s when ocean temperatures were cooler; “There is good reason to believe an extended cold-water phase in southern California would drive sand bass south, out of range of all but a few partyboats“ Partyboats = CPFVs	Young 1963; Young 1969
	1958-1961	Scientific divers make underwater observations of BSB associated with artificial reef habitats in the northern part of the Southern California Bight (SCB) but not in numbers comparable to Kelp Bass.	Carlisle et al. 1963
G	1962	In discussing the rationale for implementing a BSB tagging study "...where did the tremendous population of adult sand bass that's in our waters this summer come from, will it move away when winter comes, will it be fished out?...“	CDFG 1962
	1960-1965	Underwater observations of BSB spawning aggregations are documented by CDFW biologists. BSB are commonly encountered on diver surveys of artificial reefs, especially in Santa Monica Bay; 12–14-inch fish most common.	Turner et al. 1969
	1960s	BSB is referred to as "A more southern species frequenting our coast in and subsequent to periods of warmer waters. Because of this it is caught less commonly than kelp bass, but the two often are caught together close to bottom". "Recently, 1960 to 1970, barred sand bass have formed an important part of the sport catch."	Feder et al. 1974
	1964	BSB comprises 50% of the combined Kelp Bass and BSB catch made by private boaters.	Pinkas et al. 1965
H	early 1970s	On the population status and management of BSB, the author foreshadows a future absence of BSB in southern California, “One cloud on the horizon—barred sand bass have not always been present in large numbers in southern California.” Estimates the stock size of Kelp Bass and BSB combined at 4.2 million legal-size fish. “Sub-legal-size fish are estimated to be 5 to 10 times as numerous.”	Frey (ed) 1971
4	1972-1975	Bag limit is increased and then decreased again: 20 fish in aggregate, with not more than 10 of any one species (1972), 10 fish in aggregate, with not more than 10 of any one species (1975).	Jarvis et al. 2014
I	mid-to-late 1970s	The relative proportion of BSB in the total Kelp Bass & BSB private boat catch falls from 58% to 39% between 1975-77 and 1978-79; San Diego County (southern SCB) dominates the BSB catch in 1975-77. BSB CPUE in the late 1970s is 5-10x lower than in the late 1980s. Low CPUE in the 1970s is attributed to low abundance.	Wine 1978, 1979a,b; Love et al. 1996b
5	2013	The bag limit is reduced to 5 fish, with not more than 5 of any one species; the MSL is increased from 12 inches to 14 inches.	Jarvis et al. 2014

Figure S4 (continued). Reference table for the graphical timeline (previous page) depicting temperature trends relative to historical accounts of Barred Sand Bass *Paralabrax nebulifer* distribution and availability in California, USA, from the mid-nineteenth century to the 2010s.

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