CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE
2015 PACIFIC BLUEFIN TUNA AERIAL SURVEY

During June and July 2015, the California Department of Fish and Wildlife (CDFW), in collaboration with the California Wetfish Producers Association, conducted aerial survey operations to document Pacific bluefin tuna (PBT; *Thunnus orientalis*) abundance within the Southern California Bight (Figure 1). The survey was in response to the request by the Pacific Fishery Management Council (Council) at their June 2015 meeting for more data on the occurrence of adult fish in the Eastern Pacific Ocean to help determine whether a separate spawning population occurs in this region, and as part of a larger effort to enhance data collection. At that time there was opportunity to see sizeable schools of fish in U.S. waters based on an increase in recent catches and anecdotal information suggesting fish schools were highly visible from the air.

CDFW was able to secure airplane time beyond what was scheduled for the summer Coastal Pelagic Species (CPS) aerial survey effort, with additional ongoing support from CWPA to fund spotter pilot time (see November 2013 and June 2015 CDFW reports on the CPS aerial survey). The ultimate goal of this survey was to collect data to document PBT abundance in the Southern California Bight that could be used to develop a relative index of local abundance in the Southern California Bight, unlike other industry-initiated spotter efforts geared at locating fish for purposes of notifying fishing vessels. Initial exploratory flights were conducted in June via non-systematic searches that primarily focused on selected offshore bank areas. Subsequent flights in July were flown according to a defined survey design.

In July, four flights were completed on July 11, July 12, July 24, and July 25, using a systematic survey design covering the southern portion of the Southern California Bight, from near Santa Monica Bay to the U.S.-Mexico boundary (Figure 2). The design consisted of 22 strip transect lines spaced six nautical miles apart; transect lines were flown while the observer was looking to the right. The observed area was the six nautical mile strip between the current and subsequent transect line and it was assumed in our analyses that the observer was able to see 100 percent of the visible fish in this range. Only part of the survey design was flown due to weather and logistical constraints on aircraft availability. PBT were observed on three out of four days flown, with a count of 48 observations made of 55 schools of fish totaling an estimated 5,332 mt (Table 1, Figure 3). The majority of observations occurred in clusters of schools observed on July 11 and July 24.

On July 11, 12 observations of 17 schools were made, with a combined estimate of 1,893 mt in the offshore area west-southwest of Carlsbad Canyon (Figure 4). The survey on July 24 resulted in 27 observations of 29 schools estimated at a total of 3,132 mt. Of these 29 schools, 27 had an estimated tonnage of 3,065 mt and were observed in the vicinity of the Forty Mile Bank and 43 Spot (Figure 5). The other two schools seen on July 24 were estimated at a combined 67 mt and were observed 30 to 35 miles closer to shore. PBT were also observed on July 25 in nine scattered single-school observations totaling an estimated 307 mt. Sea surface temperatures in the area encompassed by the July observations were estimated to be between 21.0 °C and 22.5 °C (Figure 6).

The total combined July survey estimate of 5,332 mt assumes that each observation was unique; however, PBT are highly mobile and there is a chance double counting occurred over the course of the survey. If the highest estimate from a single day is used, a conservative estimate of 3,132 mt of PBT was observed.

The latest PBT stock assessment (ISC 2014) estimates 2012 spawning stock biomass at 26,324 mt for a stock that ranges across the western and eastern Pacific Ocean; this survey study area covers only a minor portion of that range. Discussions with NOAA Fisheries staff at La Jolla involved with the PBT stock assessment have suggested aerial survey data can potentially inform future assessments if more knowledge is obtained on transoceanic movement patterns and abundance over the species' entire range, but it is very unlikely these aerial survey data from the Southern California Bight can be easily or immediately applied to future stock assessment models. At this time it is not known if conditions will exist to repeat the survey in subsequent years.

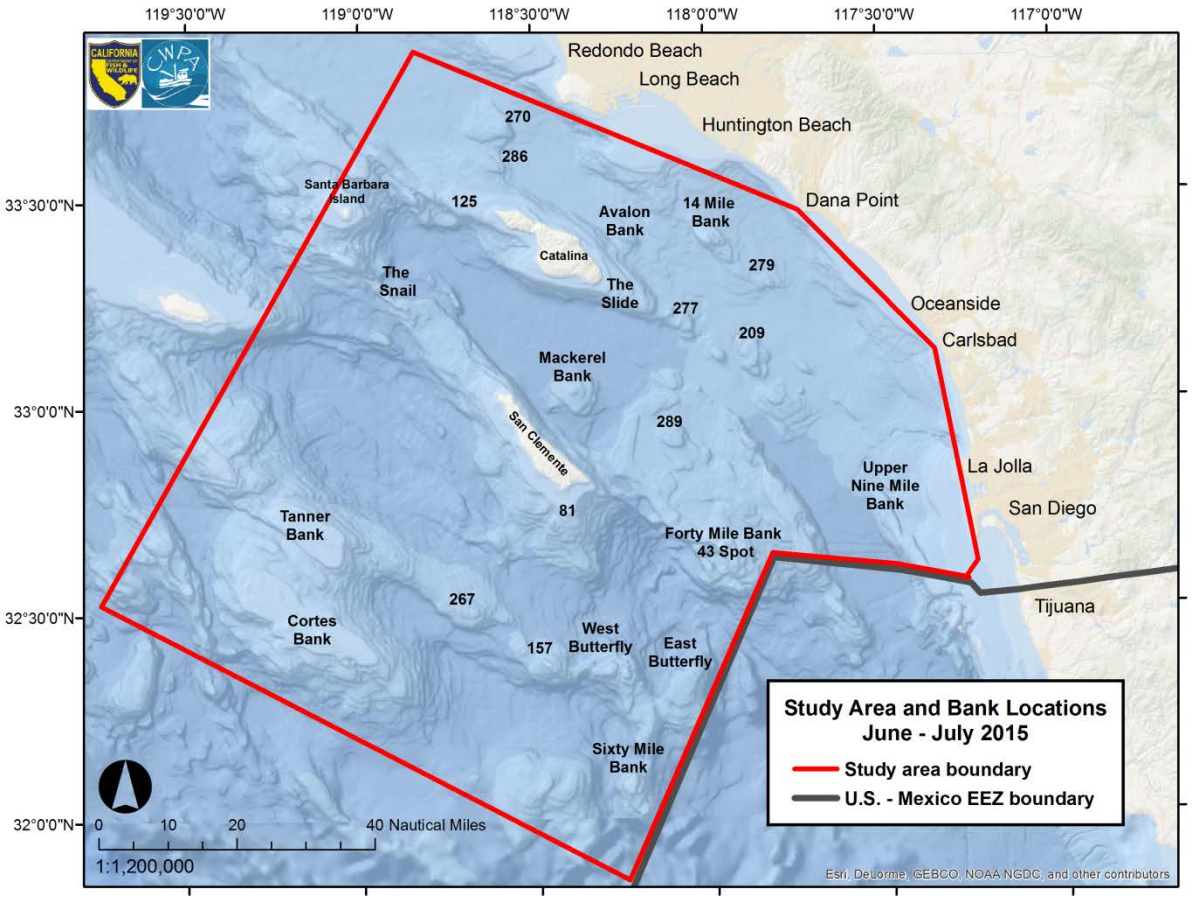

Figure 1. Study area and underwater bank locations.

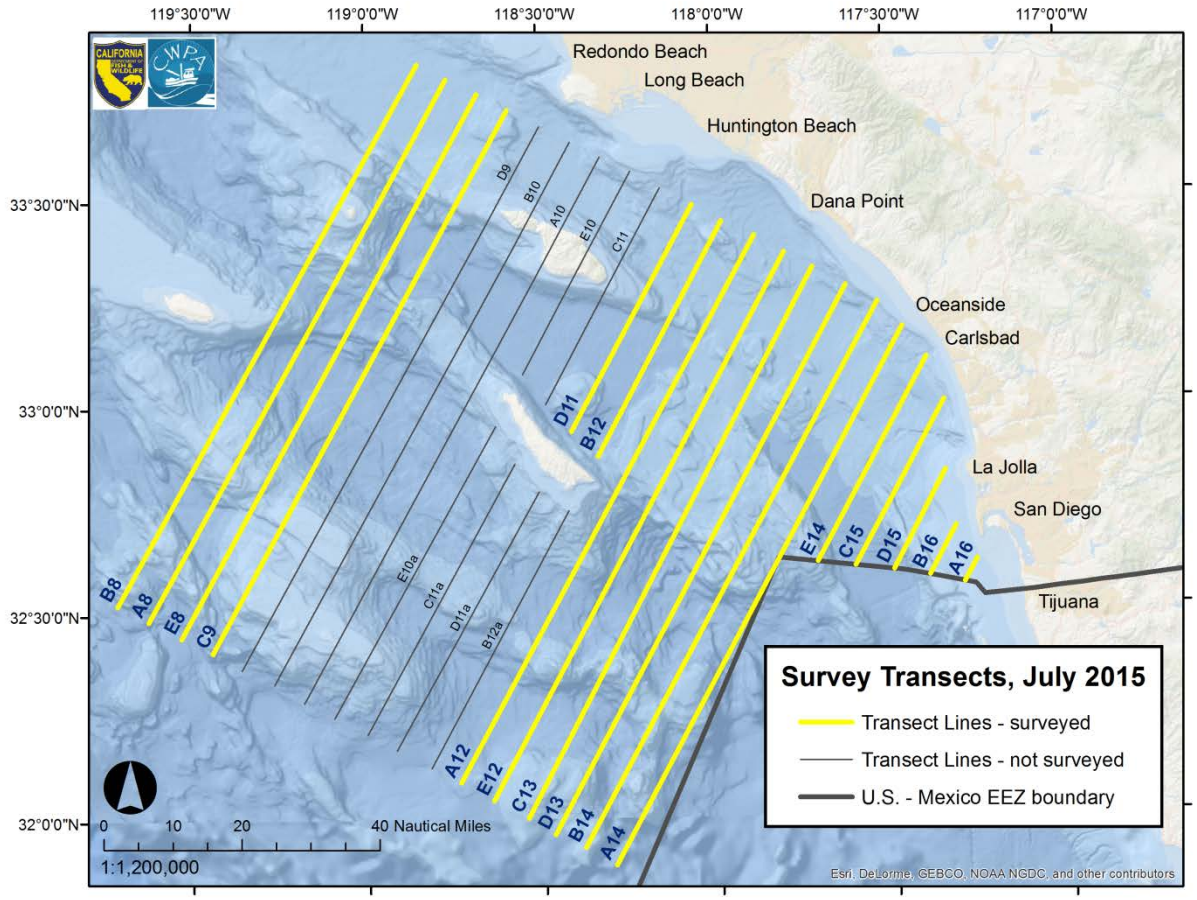

Figure 2. Surveyed (thick yellow lines) and non-surveyed (thin grey lines) transects for July 2015.

Table 1. Daily summaries of flights and observations for July 2015.

Date	Flight Type	Noted Flight Areas	Number of Observations	School Count Estimate	Estimate (metric tons)
7/11/2015	Transect line	Lines D11 & B12 NE of San Clemente Island, NE A14, E14, C15, D15, B16, and A16	12	17	1,893
7/12/2015	Transect line	Lines B8, A8, E8, and C9	0	0	0
7/24/2015	Transect line	Lines D13, B14 and SW A14	27	29	3,132
7/25/2015	Transect line	Lines A12, E12 and C13	9	9	307
		July Totals	**48**	**55**	**5,332**

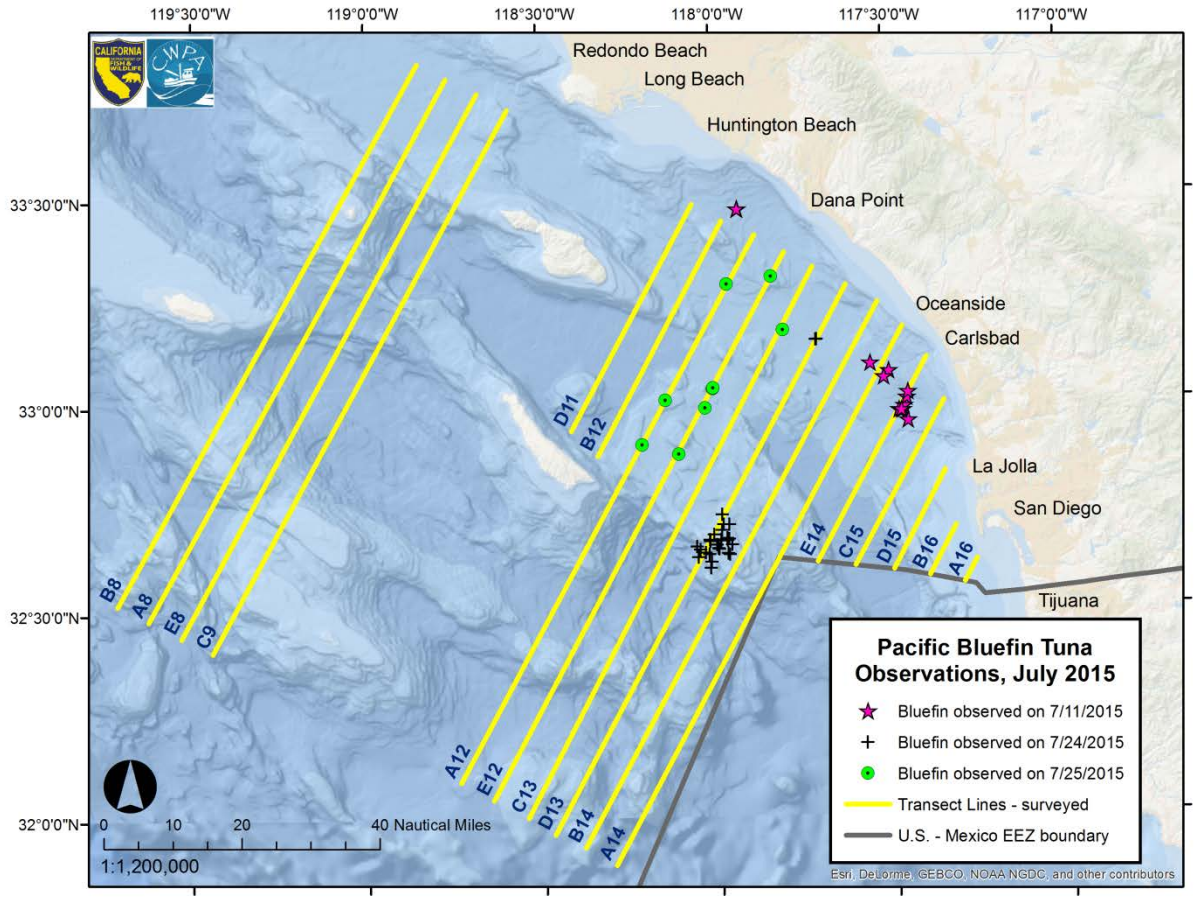

Figure 3. Pacific bluefin tuna observations for July 2015.

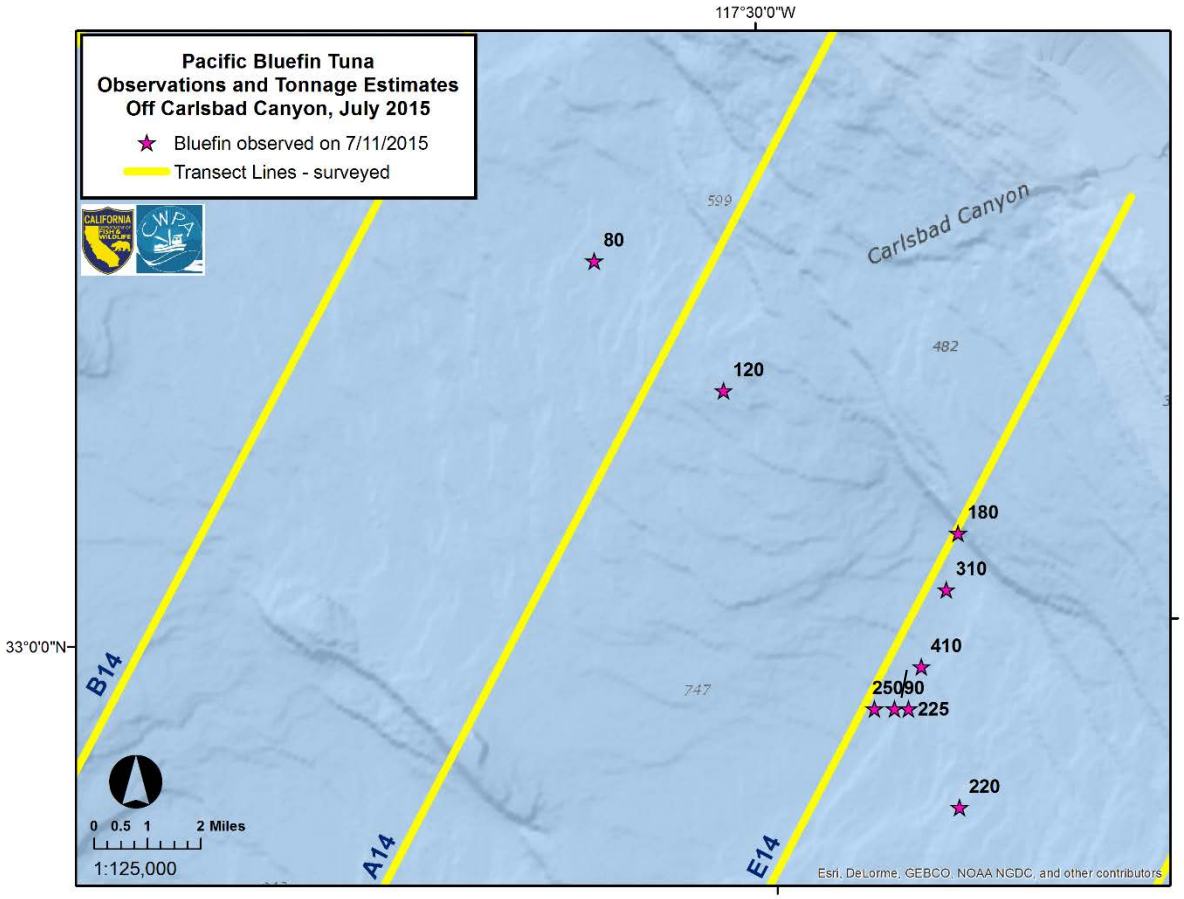

Figure 4. Pacific bluefin tuna observations (7/11/2015) with tonnage estimates off Carlsbad Canyon, total estimate approximately 1,893 mt.

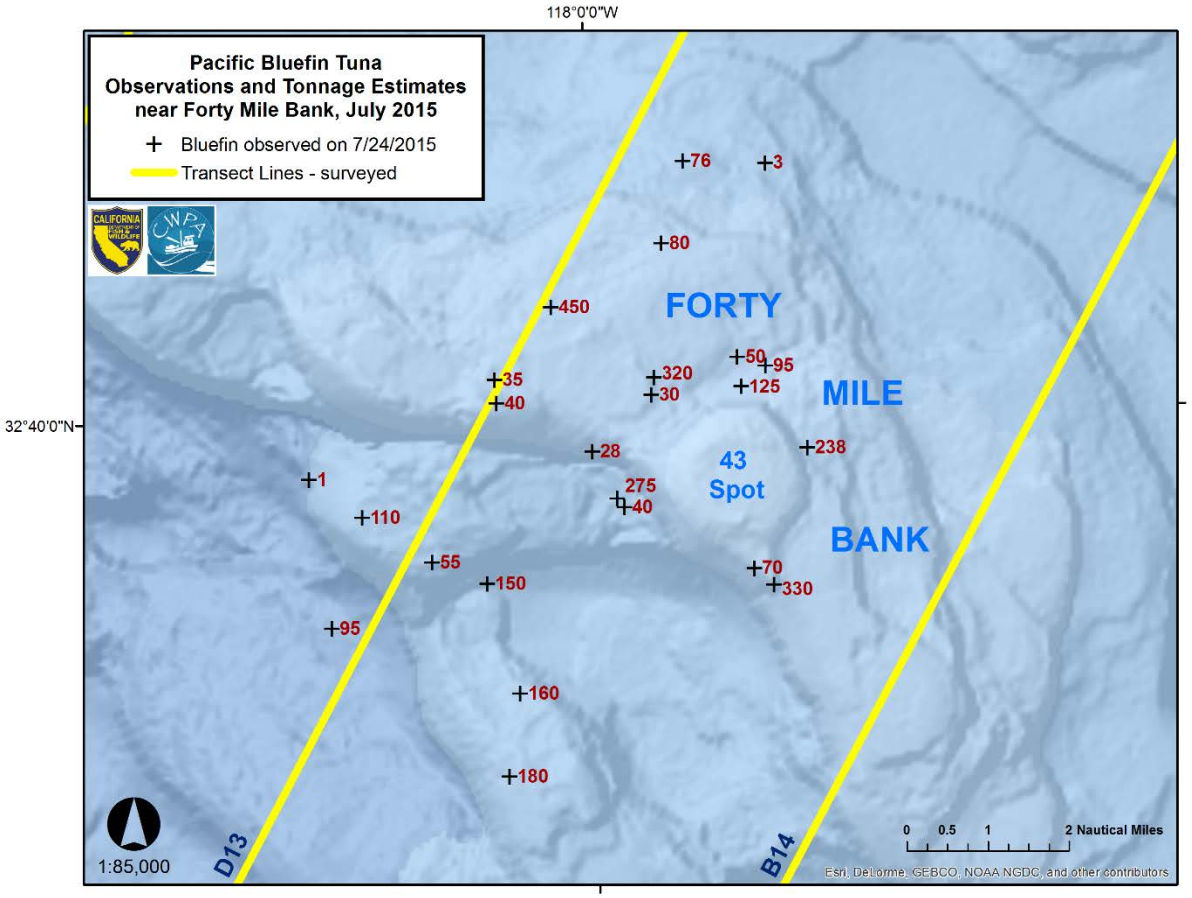

Figure 5. Pacific bluefin tuna observations (7/24/2015) with tonnage estimates near Forty Mile Bank, total estimate approximately 3,132 mt.

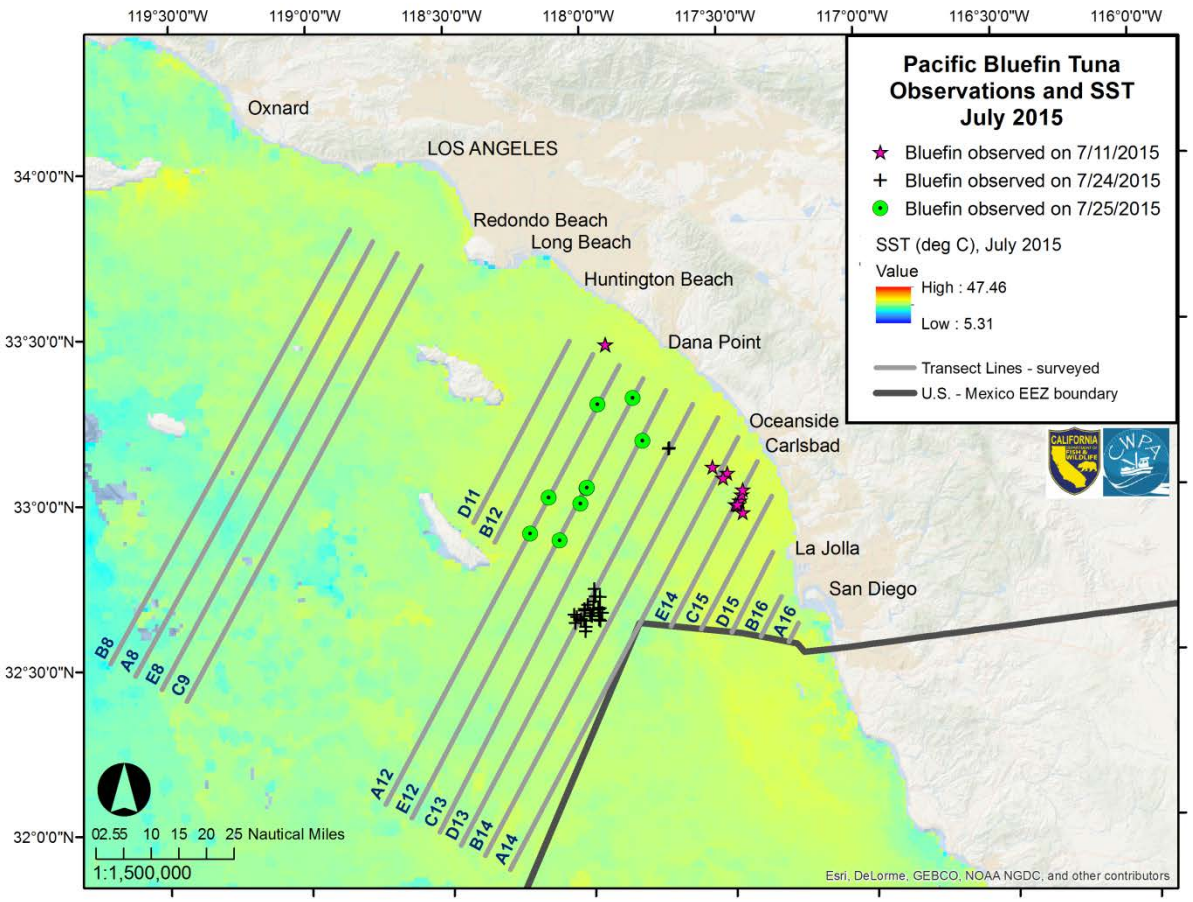

Figure 6. Pacific bluefin tuna observations in July 2015 were associated with sea surface temperatures (SST) between 21.0 °C and 22.5 °C. (SST data source: NASA Aqua MODIS, SST, July 2015 monthly composite via NOAA ERDDAP, http://coastwatch.pfeg.noaa.gov/erddap)

APPENDIX I. Observation data for Pacific bluefin tuna aerial survey, June-July 2015.

Observation Number	Observation Date	Estimate (metric tons)	Number of Schools
1	7/11/2015	no data	1
2	7/11/2015	8	5
3	7/11/2015	no data	1
4	7/11/2015	120	1
5	7/11/2015	80	1
6	7/11/2015	225	1
7	7/11/2015	410	2
8	7/11/2015	310	1
9	7/11/2015	180	1
10	7/11/2015	220	1
11	7/11/2015	250	1
12	7/11/2015	90	1
13	7/24/2015	238	2
14	7/24/2015	50	1
15	7/24/2015	450	1
16	7/24/2015	110	1
17	7/24/2015	1	1
18	7/24/2015	95	1
19	7/24/2015	55	1
20	7/24/2015	150	1
21	7/24/2015	275	1

22	7/24/2015	28	1
23	7/24/2015	40	1
24	7/24/2015	40	1
25	7/24/2015	35	1
26	7/24/2015	320	1
27	7/24/2015	30	1
28	7/24/2015	80	1
29	7/24/2015	76	2
30	7/24/2015	30	1
31	7/24/2015	95	1
32	7/24/2015	125	1
33	7/24/2015	3	1
34	7/24/2015	330	1
35	7/24/2015	70	1
36	7/24/2015	180	1
37	7/24/2015	160	1
38	7/24/2015	65	1
39	7/24/2015	2	1
40	7/25/2015	0.5	1
41	7/25/2015	2	1
42	7/25/2015	3	1
43	7/25/2015	35	1
44	7/25/2015	5	1
45	7/25/2015	35	1

46	7/25/2015	0.3	1
47	7/25/2015	225	1
48	7/25/2015	2	1

References

California Department of Fish and Wildlife (CDFW)/ California Wetfish Producers Association. 2013. Proposal for methodology review of the Southern California Bight aerial survey for inclusion into the Pacific sardine stock assessment. Pacific Fishery Management Council, November 2013 Briefing Book, Agenda Item E.4.a. Attachment 1. http://www.pcouncil.org/wp-content/uploads/E4a_ATT1_MethRVW_CDFW_CWPA_NOV2013BB.pdf

CDFW. 2015. California Department of Fish and Wildlife report on aerial survey observations of northern anchovy in the Southern California Bight. Pacific Fishery Management Council, June 2015 Briefing Book, Agenda Item G.3.a. Supplemental CDFW Report. http://www.pcouncil.org/wp-content/uploads/2015/06/G3a_Sup_CDFW_Rpt_JUN2015BB.pdf

International Scientific Committee (ISC). 2014. Stock assessment of bluefin tuna in the Pacific Ocean in 2014. In: Annex 4. Report of the Pacific Bluefin Tuna Working Group, International Scientific Committee for Tuna and Tuna-like Species in the North Pacific Ocean, pp.121.