

CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE REPORT ON AERIAL SURVEY OBSERVATIONS OF NORTHERN ANCHOVY IN THE SOUTHERN CALIFORNIA BIGHT

Since the summer of 2012, the California Department of Fish and Wildlife (CDFW) has collaborated with the California Wetfish Producers Association (CWPA) on an aerial survey for coastal pelagic species (CPS) within the Southern California Bight (SCB) (Lynn and Pleschner-Steele 2013, Lynn et al. 2014). The biannual survey (spring and summer) covers waters off Point Conception southward to the U.S. – Mexico border. Aerial transects have been flown along mainland and island coastlines as well as across open water areas (Figure 1). The importance of sampling nearshore waters is due to species such as Pacific sardine and northern anchovy often seen in California waters in aggregations along the coast, as well as providing intensive coverage of the coastal area within one nautical mile (nm) from shore that is not provided by other NMFS CPS surveys. In conjunction with the aerial surveys, boat sampling has been conducted every season to verify aerial species identification and collect CPS samples. The goal of the survey is to document location and size of CPS schools within the SCB, and collect biological information from boat sampling. The survey initially focused on Pacific sardine, and later added northern anchovy and mackerel species beginning summer 2013. This report summarizes survey methods and data collected specifically on northern anchovy.

Methods

Aerial Survey

Nearshore coastal transects were flown along the coastlines of the mainland and each of the Channel Islands, and were approximately 1.0 - 1.5 nm off shore (Figure 1). Coastal transect width extended to the shore, except where visibility was limited by macroalgae. In addition, open water transects were flown along sixteen transect lines spaced 15 nm apart, originating at 3 nm from the mainland and extending offshore to the outer Channel Islands. For each season, transects have been flown once.

Timing and selection of aerial transects during a field season were dependent on weather conditions, airspace restrictions, and availability of staff and aircraft. Strip transects were flown using a CDFW Partenavia P.68 Observer aircraft piloted by a CDFW warden-pilot, with an experienced industry spotter pilot looking to the right. Coastal transects were initially flown at 1,000 feet altitude to maximize observer identification, and open water transects at 2,000 feet to maximize observer coverage and transect width; this was standardized to 1,500 feet altitude for both transect types with the summer 2014 season. When fish schools were identified and confirmed, the aircraft was redirected directly over the fish to position for photographs. The camera system software was interfaced with a GPS unit to record time, location, speed, altitude and other information with each image taken. The spotter pilot estimated number of schools and metric tonnage (including percent species composition of mixed schools), and a CDFW biologist operated the camera system and recorded other information such as

weather, viewing conditions and plane actions. Photos were used to supplement field notes for school location, size and count. Additional schools seen on photographs were verified with the observer and, if confirmed, were added to field-collected data and included in analyses. After observed schools were photographed, the plane returned to the transect flight line path and resumed the survey.

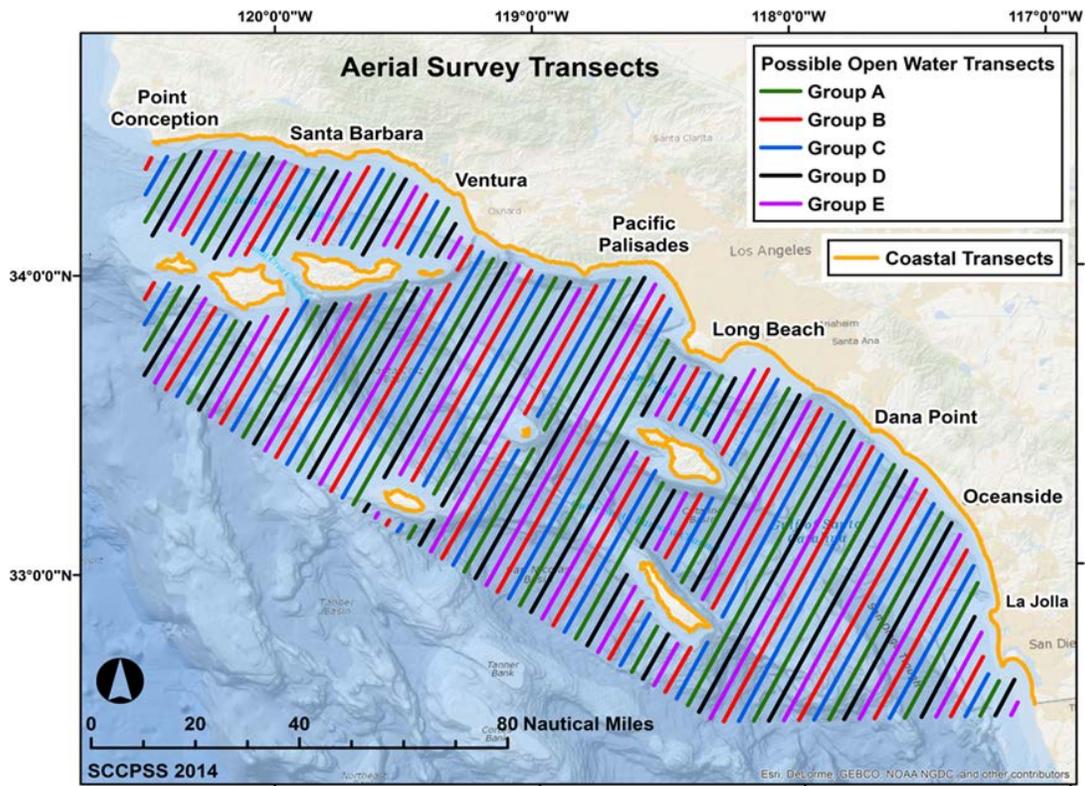


Figure 1. Aerial survey study area and design. Coastal mainland and island transects (orange lines) have been flown for all seasons, while one group of open water transects (e.g., either A, B, C, D, or E) was randomly chosen and flown for each of the 2012-2013 and summer 2014 seasons.

Boat Sampling

Boat surveys were guided by aircraft observations of CPS to specific areas for sampling. From summer 2012 through summer 2014, waters off Santa Catalina Island and off the northern Orange County coast were sampled. Underwater tow camera, diver video and hook-and-line sampling methods were used to validate aerial observer identification of species, and to provide information on size, maturity and age of the observed fish, and a Secchi disk was used to determine water clarity. Information on sea-surface temperature (SST), temperature at depth, as well as school density at relative depths and water depth were also collected from the SONAR aboard the vessel. Aerial species identifications were noted and compared with results of boat sampling.

Survey Observations - Northern Anchovy

Northern anchovy schools have been observed from the start of the survey (Figure 2, Table 1). They have primarily been found along the mainland coast. Large aggregations have been frequently seen off the Ventura-Santa Barbara coast, and to a lesser extent off Long Beach and San Diego. The large schools

and groups of schools off the North Coast mainland near Ventura have been seen during transects for the three seasons spanning spring 2013 to spring 2014. In addition, four observations totaling an estimated 1,110 mt were observed in the same area during the summer 2014 season (Appendix I). Northern anchovy have been seen in mixed schools together with Pacific sardine, but generally not with Pacific or jack mackerel species.

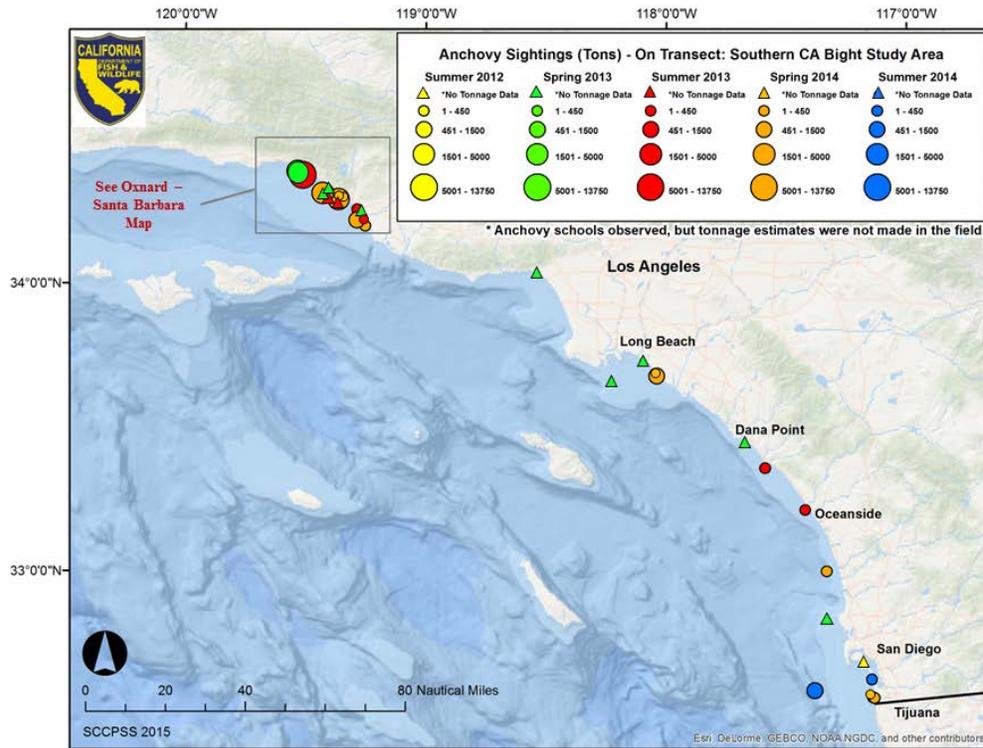


Figure 2. Map of northern anchovy observations from aerial transects, Summer 2012 – Summer 2014. Note additional observations from first two seasons with no tonnages estimated (triangles).

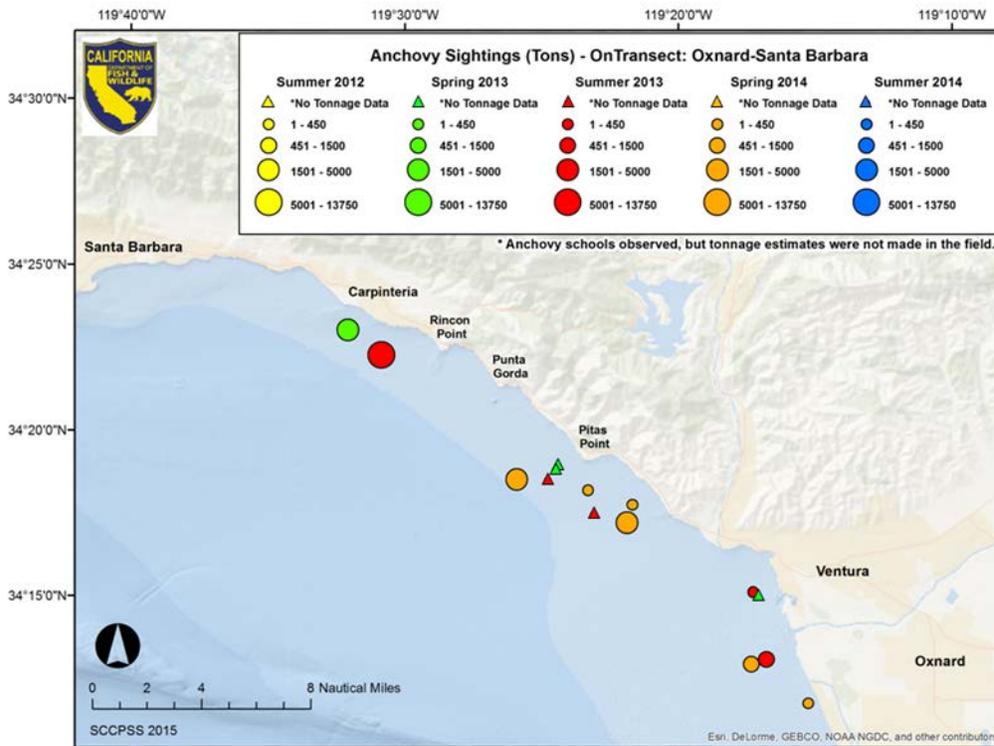


Figure 3. Large-scale map of northern anchovy observations from aerial transects for Oxnard – Santa Barbara area.

Table 1. Summarized northern anchovy observations data from aerial transects by season, Summer 2012 – Summer 2014. All observations but one from summer 2014 were from coastal mainland transects. Spotter pilot estimates (metric tons), the number of total sightings, number of sightings with and without tonnage estimates, average mt per sighting, and the number of sightings per species composition categories (pure or mixed) are included. Mixed schools consisted of northern anchovy and Pacific sardine only.

Season	Total Estimate (mt)	Num. Sightings (Total)	Num. Sightings (w/Estimates)	Num. Sightings (w/o Estimates)	Avg mt/sighting	Species composition of sightings	
						Pure	Mixed
Summer 2012 (Jul-Aug)	0	1	0	1	N/A	1	-
Spring 2013 (Apr-May)	5,000	9	1	8	5,000	7	2
Summer 2013 (Aug-Oct)	14,532	7	5	2	2,906	4	3
Spring 2014 (May-Jun)	6,810	11	11	0	619	10	1
Summer 2014 (Aug)	980	2	2	0	490	2	-
TOTAL	27,322	30	20	11	911	24	6

Discussion

Northern anchovy have been observed in every season of the survey, almost exclusively along the mainland coast. The aerial coastal surveys cover 1.0 – 1.5 nautical miles off shore and represent a census of these areas. Future aerial transects may include additional bands radiating outwards to cover more area, as well as additional transect replicates to increase statistical power. In addition to current video and hook and line gear, future boat surveys may include the use of gillnets to increase catch rate and sampling efficiency. Moreover, the use of these nets is expected to decrease potential sampling bias due to hook size.

References

Lynn, K. and D. Pleschner-Steele. 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.

Lynn, K., D. Porzio, and A. Kesaris. 2014. Aerial sardine surveys in the Southern California Bight. California Fish and Game 100(2): 260-275.

Appendix I. Northern anchovy observations from off-transect or boat survey operations for the entire study area (top) and Huntington Beach – Los Angeles area (bottom).

