

# REVIEW OF THE 1962 SEASONAL MOVEMENT OF ALBACORE TUNA OFF THE PACIFIC COAST OF THE UNITED STATES

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## ABSTRACT

Review of the 1962 seasonal movement of albacore tuna (*Thunnus* *germo*) off the Pacific Coast of the United States as revealed by U. S. Navy picket vessels monitoring fixed, continuously manned stations. Onshore and northward migration of albacore is related to rapid changes in corresponding 15-day sea surface temperature charts. Onset, termination of fishing at each station is reported, and relation to "optimum" sea temperatures is discussed. A schematic model of seasonal albacore movement of the Pacific Coast as suggested by 1960-62 catch data is presented.

## BACKGROUND

As in the years since 1956, the U. S. Navy has continued its operation of the radar early warning surveillance network off the west coast of the United States. Coverage in 1962 extended from latitudes 31° N. to 50° N. at a distance from 200-500 miles from shore. A fleet of several vessels participated in the continuous-rotation schedule which required most ships to visit each station during the year for 20-30 day intervals.

In 1962 the joint U. S. Navy-U. S. Bureau of Commercial Fisheries cooperative picket vessel trolling program completed its third and most successful year. A total of 724 albacore was landed by the picket fleet. A large measure of the success can be attributed to the high degree of participation by picket vessel crew members. Recreational opportunities at sea are limited, and the fishing program has filled a vital need. The Bureau supplies each vessel with a kit of fishing gear and measuring board. Each kit contains several sets of trolling rigs made up of a 30-fathom line, shock-cord assembly, and standard commercial leather jig. All vessels troll with lines lashed to the stern rail, maintaining about 3-4 knots of steerage-way while steaming on station. A few catches were made by ships making speeds up to 8 knots.

As in previous years, the picket vessels commenced fishing on May 1 and terminated on November 1, the close of an average season. Late-season catches were made by the vessel Locator on November 1 and 7-10 inclusive.

## RESULTS

The first catch of the 1962 season was reported by the U. S. S. Koiner at station 5 on June 11 (table 1). Fishing subsequently continued at this station well into July with few interruptions. Water temperatures ranged from 59°-60° F. at the beginning of fishing activity and rose to 64°-66° F. at the end. Albacore appeared at station 4 one week later (June 17), and at station 3 twenty-five days later (July 6). Station 2 reported the first albacore on August 7, whereas station 1 logged the first catch of the year on August 6. Fishing at station 6 was conducted on an intermittent basis; consequently, the date of earliest albacore catch does not necessarily represent the date of arrival of the first migrants.

Table 1 - Date of First Albacore Catch and Water Temperature at U. S. Navy Radar Picket Stations, 1962

Station Number	Approximate Position		Date of First Catch	Water Temp. (°F.)
	Latitude	Longitude		
1	50° N.	134° W.	August 6	62
2	45° N.	135° W.	August 7	63
3	42° N.	129° W.	July 6	59
4	40° N.	133° W.	June 17	59
5	35° N.	132° W.	June 11	59
6 <sup>1/</sup>	30° N.	128° W.	July 19	64

<sup>1/</sup>Fishing on intermittent basis - not continuous in early season.

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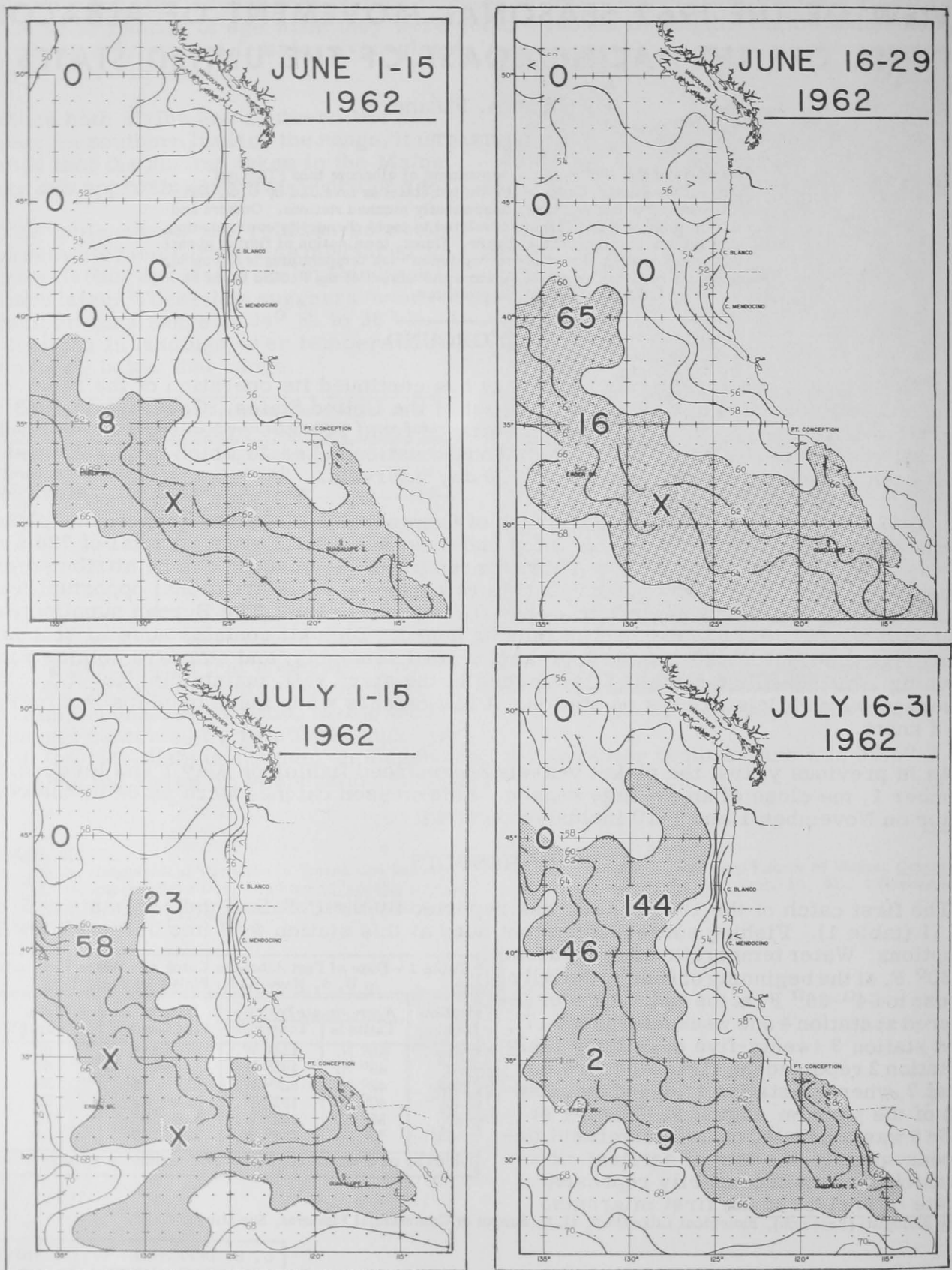


Fig. 1 - Albacore catch by U. S. Navy radar picket vessels in June-July 1962. Large numerals represent the catch at each station; small numerals indicate water temperature; and "X" indicates no fishing during the period. Shaded area delimits the 60°-66° F. temperature zone. More than two-thirds of the 1954-1958 California commercial albacore landings for June-September were taken from waters within these temperature limits.

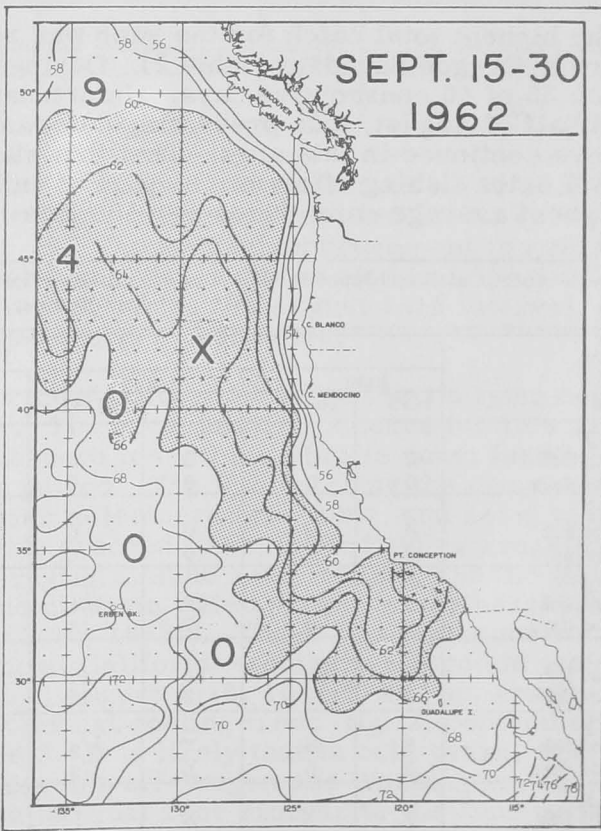
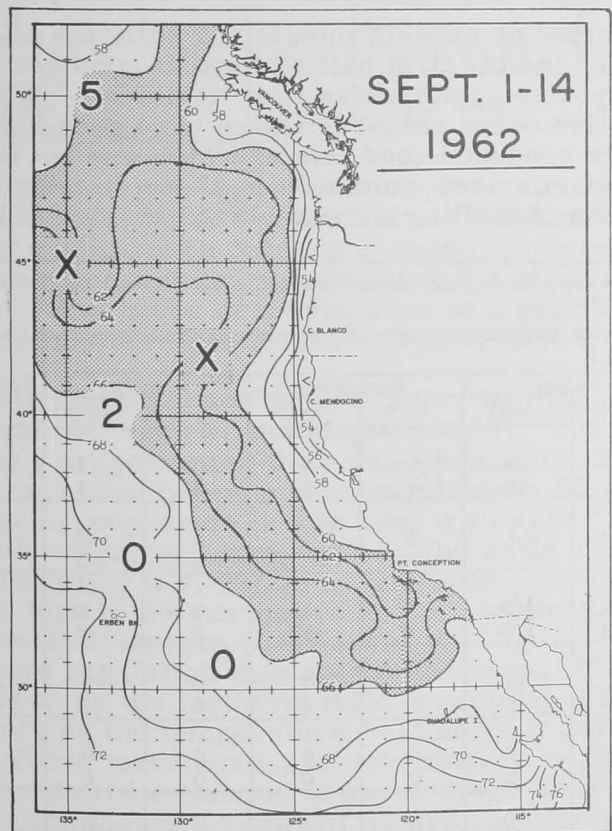
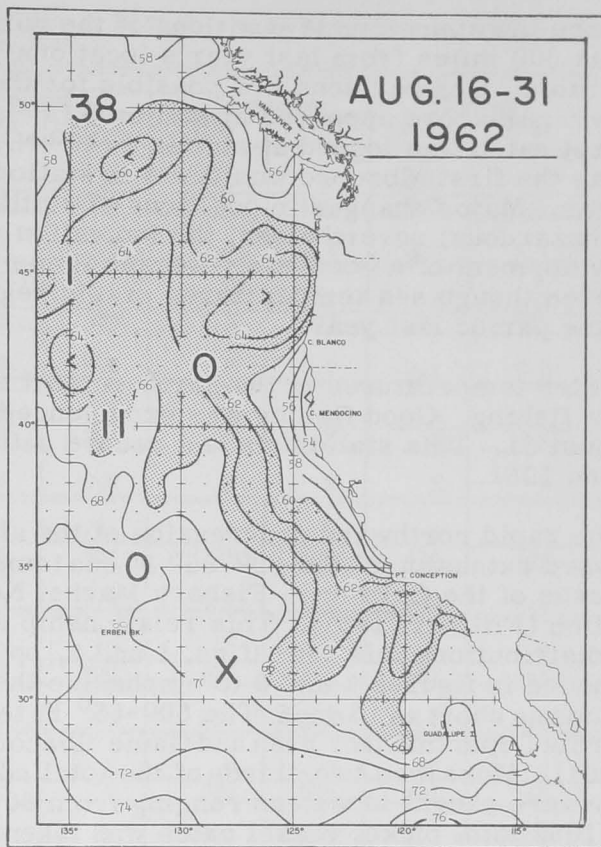
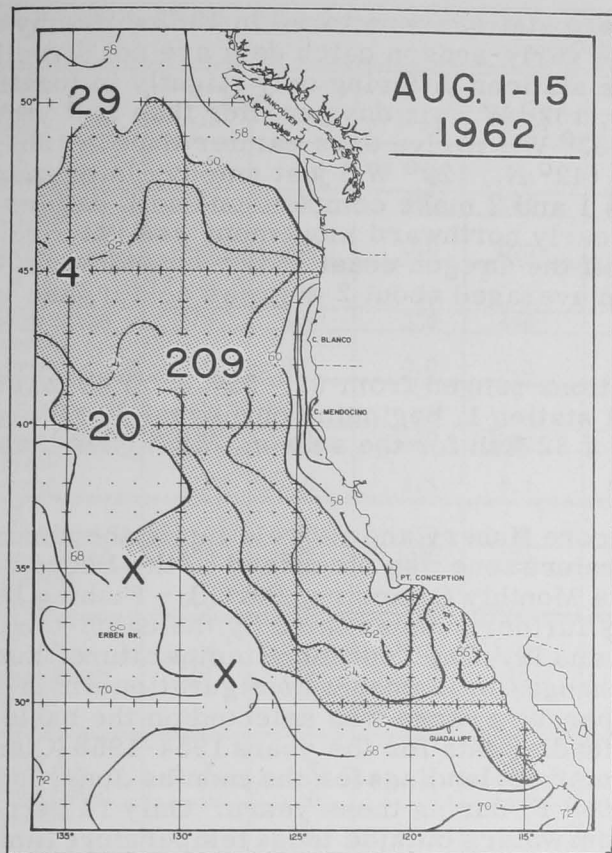


Fig. 2 - Albacore catch by U. S. Navy radar picket vessels in August-September 1962. Large numerals represent the catch at each station; small numerals indicate water temperature; and "X" indicates no fishing during the period. Shaded area delimits the 60°-66° F. temperature zone. More than two-thirds of the 1954-1958 California commercial albacore landings for June-September were taken from waters within these temperature limits.

Since the approximate positions of the northern stations monitored in 1962 differ by as much as 300 miles from last year's locations, the early-season catch data are not directly comparable. Comparisons are possible for those stations differing only slightly in location, however. Albacore appeared at station 5 (35° N., 132° W.) six days earlier than last year. The first catch was logged at station 4 (40° N., 133° W.) twelve days earlier than in 1961, whereas the first albacore was taken at station 3 (42° N., 129° W.) just one day later than last year. Major changes in positions of stations 1 and 2 make comparisons with earlier years hazardous; nevertheless, the indication of early northward movement was verified by the development of a good early-season fishery off the Oregon coast in the second week of July, even though sea temperatures in this region averaged about 2 degrees colder than in the same period last year.

Water temperatures at the northernmost stations ranged from 62°-63° F. at commencement of fishing. Good fishing was experienced at station 1, beginning on August 6, and ending on August 31. This station made a record catch of 82 fish for the season, far higher than in 1960 and 1961.

The rapid northward progression of the albacore fishery and its relation to the annual northward extension of the 60°-66° F. sea temperature zone was discussed in the December 1961 issue of the California Fishery Market News Monthly Summary, Part II - Fishing Information (Flittner, 1961). This relationship was further substantiated by the catch-temperature distributions this year (figs. 1 and 2, pp. 8 and 9). The "optimum temperature" zone was shaded in figures 1 and 2 to emphasize the changes in isotherm configuration which occur in periods as short as 15 days. The 60°-66° F. temperature range was selected on the basis of California Department of Fish and Game albacore landing data for the years 1954-1958 (Clemens 1961). More than two-thirds of the total commercial landings for the months June-September were caught in waters ranging from 60°-66° F. during these years. Only 14 percent of the 1962 total picket vessel catch was taken from waters outside these temperature limits.

The highest total catch for the year was reported by vessels monitoring station 3 off the California-Oregon boundary (table 2). During July and the first half of August, catches were made on 35 of 46 consecutive days. Unfortunately, fishing activities were terminated in the second half of August, thus preventing determination of the actual length of time good fishing may have continued in this area. That this station produced good fishing which was not the result of extra fishing effort on the part of enthusiastic crew members is shown in table 3. The highest average catch rates per 100 line-hours of trolling were achieved at this station.

Table 2 - Albacore Catch and Number of Days Which Fish Were Taken by U. S. Navy Radar Picket Vessels Trolling on Station, June-October, 1962

Station and Item	Period										Totals
	June		July		August		September		October		
	1-15	16-30	1-15	16-31	1-15	16-31	1-14	15-30	1-15	16-31	
1											
Number of fish	0	0	0	0	29	38	1/5	9	1/0	1	82
Number of days	0	0	0	0	6	10	1/4	2	1/0	1	23
2											
Number of fish	0	0	0	0	1/4	1/1	X	1/4	1	0	10
Number of days	0	0	0	0	1/2	1/1	X	1/4	1	0	8
3											
Number of fish	0	0	23	144	209	1/0	X	X	X	X	376
Number of days	0	0	7	13	15	1/0	X	X	X	X	35
4											
Number of fish	0	65	58	46	20	1/11	2	1	0	2	205
Number of days	0	11	12	11	6	1/6	2	1	0	1	50
5											
Number of fish	8	16	X	1/2	X	0	0	0	0	0	26
Number of days	3	6	X	1/2	X	0	0	0	0	0	11
6											
Number of fish	X	X	X	1/9	X	X	0	0	0	0	9
Number of days	X	X	X	1/2	X	X	0	0	0	0	2
Total number of fish	8	81	81	201	262	50	7	14	1	3	708
Total number of days	3	17	19	28	29	17	6	7	1	2	129

1/Station not fished entire period.

Table 3 - Albacore Catch, Catch Rates and Distribution of Fishing Effort by U. S. Navy Radar Picket Vessels Trolling on Station, June-October, 1962

Station and Item	June		July		Period August		September		October		Totals
	1-15	16-30	1-15	16-31	1-15	16-31	1-14	15-30	1-15	16-31	
<u>1</u>											
Number of fish	0	0	0	0	29	38	1/5	9	1/0	1	82
Line-hours fished	420	420	480	184	456	1526	504	198	840	1920	6948
Catch per 100 line-hours	0.0	0.0	0.0	0.0	6.4	2.5	1.0	4.6	0.0	0.1	1.2
<u>2</u>											
Number of fish	0	0	0	0	1/4	1/1	X	1/4	1	0	10
Line-hours fished	356	488	328	448	528	336	X	432	675	176	3767
Catch per 100 line-hours	0.0	0.0	0.0	0.0	0.8	0.3	X	0.9	0.1	0.0	0.3
<u>3</u>											
Number of fish	0	0	23	144	209	1/0	X	X	X	X	376
Line-hours fished	420	448	1520	1776	1340	224	X	X	X	X	5728
Catch per 100 line-hours	0.0	0.0	1.5	8.1	15.6	0.0	X	X	X	X	6.6
<u>4</u>											
Number of fish	0	65	58	46	20	1/11	2	1	0	2	205
Line-hours fished	468	1602	1032	720	726	364	1728	1632	420	416	9108
Catch per 100 line-hours	0.0	4.1	5.6	6.4	2.8	3.0	0.1	0.1	0.0	0.5	2.2
<u>5</u>											
Number of fish	8	16	X	1/2	X	0	0	0	0	0	26
Line-hours fished	307	758	X	216	X	500	637	156	420	448	3442
Catch per 100 line-hours	2.6	2.1	X	0.9	X	0.0	0.0	0.0	0.0	0.0	0.8
<u>6</u>											
Number of fish	X	X	X	1/9	X	X	0	0	0	0	9
Line-hours fished	X	X	X	138	X	X	630	576	420	448	2212
Catch per 100 line-hours	X	X	X	6.5	X	X	0.0	0.0	0.0	0.0	0.4
<b>Totals:</b>											
Number of fish	8	81	81	201	262	50	7	14	1	3	708
Line-hours fished	1971	3716	3360	3482	3050	2950	3499	2994	2775	3408	31205
Catch per 100 line-hours	0.4	2.2	2.4	5.8	8.6	1.7	0.2	0.5	0.0	0.1	2.3

1/Station not fished entire period.

During the July 1-August 15 interval mentioned earlier, catch rates rose from 1.5 to 15.6 fish per 100 line-hours, respectively. Optimum water temperatures prevailed for an extended period beginning on July 1 and ending on October 15. The gradual improvement in average fishing success through the season for all stations combined is shown also in table 3. Catch per 100 line-hours of fishing rose to a peak of 8.6 fish during the August 1-15 interval, dropped sharply during August 16-31, and then declined steadily thereafter.

For the third consecutive year, trolling was most successful in the region lying between latitudes 40°-42° N. and longitudes 128°-134° W. The accumulated evidence for this area strongly suggests that the annual migration of albacore toward the Pacific coast feeding areas centers in this region and extends over a 60-day period. The fish entering the coastal waters appear to congregate in this area within the "optimum temperature" zone, and seem to split into two migratory components: the early arrivals proceed to southern feeding areas within the prevailing NW.-SE. oriented isothermal pattern (fig. 1, June 1-15, 16-29), and the late arrivals turn to the northward as soon as the tongue of warm water proceeds northeastward to the coast off Oregon and Washington (fig. 1, July 1-15, 16-31). These two segments of the albacore population then appear to merge off central California-southern Oregon in the month of August as the isotherm field consolidates (fig. 2, August 1-15, 16-31), and apparently move offshore as the temperature field commences its annual cooling trend (fig. 2, September 15-30). These movements are schematized in figure 3. It is likely that in cold years, when the northeastward extension of warm water fails to develop off Oregon and Washington, the entire population moves southward toward the coast in a thermal zone similar to the June pattern.

That fishing may continue into late fall within these thermal limits is further evidenced by the November catch of 16 albacore (ranging from 7-11 lbs.) by the U. S. S. Locator at sta-

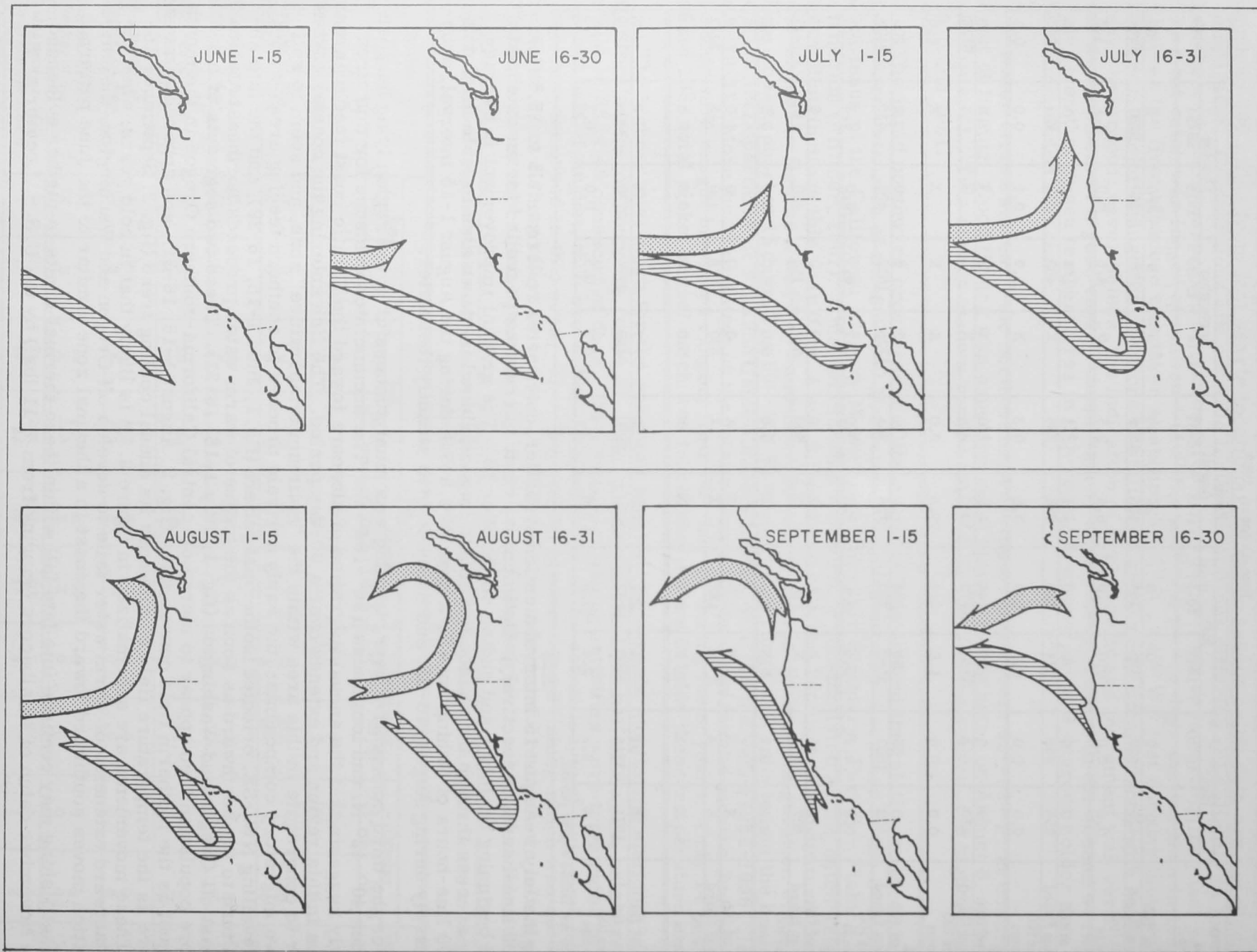


Fig. 3 - Schematic model of albacore movement off the Pacific coast as suggested by U. S. Navy picket vessel catch data, 1960-1962. Hatched arrow represents the southern (early) migratory component; stippled arrow represents the northern (late) migratory component.

tion 4. This catch of small fish was coincident with persistent late-season fishing into October and early November off southern California, when small fish were reported to be very abundant.

The U. S. S. Picket carried off the honors in total catch this year: 309 albacore were landed of a grand total of 724 fish for all vessels combined. This vessel also held top position in daily catch: 37 albacore were taken at station 3 on both July 29 and August 8.

Age-group representation in the 1962 picket vessel catch varied considerably from 1961. Whereas in 1961 the 31-inch group (78-80 cm.) comprised about 24 percent of the total catch, this year it made up less than 3 percent of the catch (fig. 4). The 25-inch (62-64 cm.) group dominated the 1962 catch, making up approximately 58 percent of the total; last year it contributed about 40 percent of the catch. The 21-inch (52-53 cm.) group contributed 38 percent of the total catch, about the same percentage as last year. The remaining 1 percent of the 1962 catch consisted of both very small and large albacore. A 15-inch albacore (38 cm.) was taken at station 3 on July 21, and a 38-inch fish (97 cm.) weighing 42 pounds was caught at station 6 on July 18.

The high degree of correlation between sea temperatures and albacore distribution and availability can be seen readily from the preceding figures. The rapid shift in geographic distribution of sea temperature and catch in periods as short as 15 days should be of particular interest to all fishermen. A method of predicting sea temperature distributions is being sought.

The continuing enthusiasm on the part of Radar Picket Squadron One personnel made the 1962 season most successful. Although two vessels (Picket, 309 fish; Watchman, 160 fish) took the major portion of the catch, the smaller catches and negative reports from other participating vessels were of equal value in contributing to our understanding of the distribution of albacore off the Pacific coast. Once again, tuna researchers and albacore fishermen alike are grateful to the officers and men of Radar Picket Squadron One for their continued interest and participation in the trolling program.

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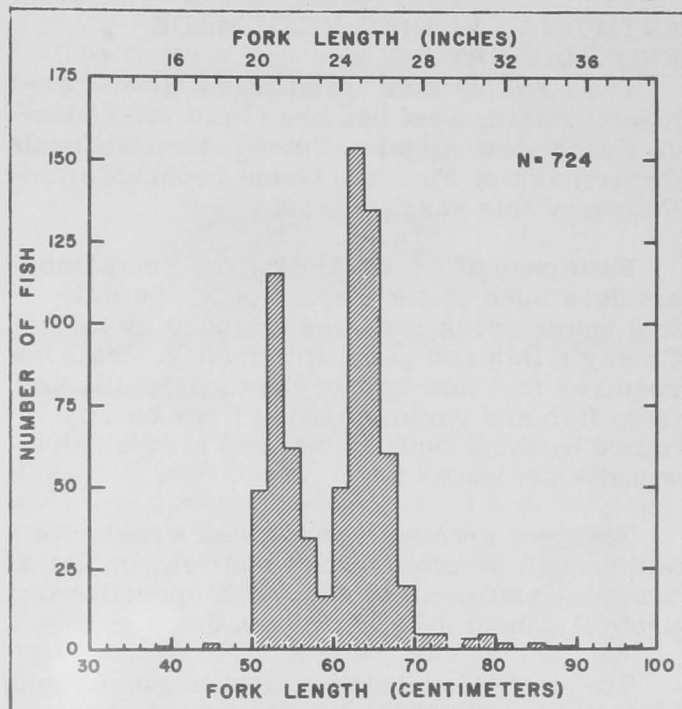


Fig. 4 - Length-frequency distribution of albacore taken by U. S. Navy radar picket vessels trolling on station, June-November 1962. All stations combined.

