

# Occurrence of Two Species of Young Threadfin, *Polydactylus opercularis* and *P. approximans*, in the Offshore Waters of the Eastern Tropical Pacific Ocean

W. L. KLAWE and F. G. ALVERSON<sup>1</sup>

TWO SPECIES of threadfin,<sup>2</sup> (*Polydactylus*, Polynemidae), occur along the Pacific coast of the Americas. *P. opercularis* ranges from the upper portion of the Gulf of California to northern Peru; *P. approximans* is found from southern California to northern Peru (Hildebrand, 1946; Berdegúe, 1956). The two are known collectively as "bobo" by U. S. West Coast tuna fishermen who capture them for bait from Santa Maria Bay, Mexico, to the Gulf of Guayaquil, Ecuador (Alverson and Shimada, 1957). Adults of both species commonly occur in inshore waters, where they are utilized for food by the indigenous human population. The juveniles, however, have often been found at a considerable distance offshore, where they are, on occasion, found in quantity.

Information concerning the offshore occurrence of young *Polydactylus* was obtained from two sources: (1) logbooks kept by the masters of tuna clippers, in which a record of navigational and fishing activities, including the procurement of bait, is kept; and (2) collections made by scientists from the Scripps Institution of Oceanography, Bureau of Commercial Fisheries, Inter-American Tropical Tuna Commission, and other institutions. The bobo taken by the tuna fishermen were captured with either a lampara net or a crowder, a small net used to concentrate bait in the wells (Godsil, 1938; Alverson and Shimada, 1957). Listed in Table 1, by date of capture, are the locations and amounts of bobo taken for use as bait. The locations of capture have been plotted in Figure 1. Practically all the collections taken by scien-

tists were made with the aid of a night light, an electric light suspended outboard of a drifting vessel so that the organisms attracted may be dipped out with a fine-mesh net. Listed in Table 2, for each threadfin collection made by scientific personnel, is the date and location of capture, number, size-range, and species. The locations of capture have been plotted in Figure 2.

In our collections the young of both species were not taken beyond 100 miles offshore, north of the Gulf of Tehuantepec, and 250 miles offshore south of the Gulf, the only exception being the occurrence of *P. approximans* in the vicinity of the Galapagos Islands, some 600 miles offshore (Figure 2). These limits are probably fairly accurate descriptions of the offshore distribution as numerous collections to the westward (Klawe, 1963) did not yield any young.

*P. approximans* has been recorded from 27:38 N and 114:50 W (off Turtle Bay, Baja California) in the north to 5:52 S and 81:28 W (off Point Aguja, Peru) in the south. *P. opercularis* has been recorded from 23:55 N and 108:00 W (Gulf of California) in the north to 5:52 S and 81:28 W in the south. The north-south offshore distribution of the young, of both species, is similar to the north-south inshore distribution of the adults.

The specimens of *P. opercularis* collected by night lighting and other methods, excepting the bait fishery, had a size-range of 7-87 mm, the vast majority being less than 50 mm in fork-length (Table 2). Three samples of *P. opercularis* which were given to the Commission by tuna fishermen had size-ranges of 46-67 mm, 58-72 mm, and 63-89 mm, respectively (Table 1). The length-frequency distribution of two of these samples has been plotted in Figure 3. Specimens of *P. approximans* collected by methods other than the bait fishery ranged in size

<sup>1</sup> Inter-American Tropical Tuna Commission, La Jolla, California. Manuscript received December 20, 1962.

<sup>2</sup> The following names are used for threadfin in some of the Latin American countries: ratón, aleta de hebra in Mexico, amarillo in Ecuador, and barbudo in Peru.

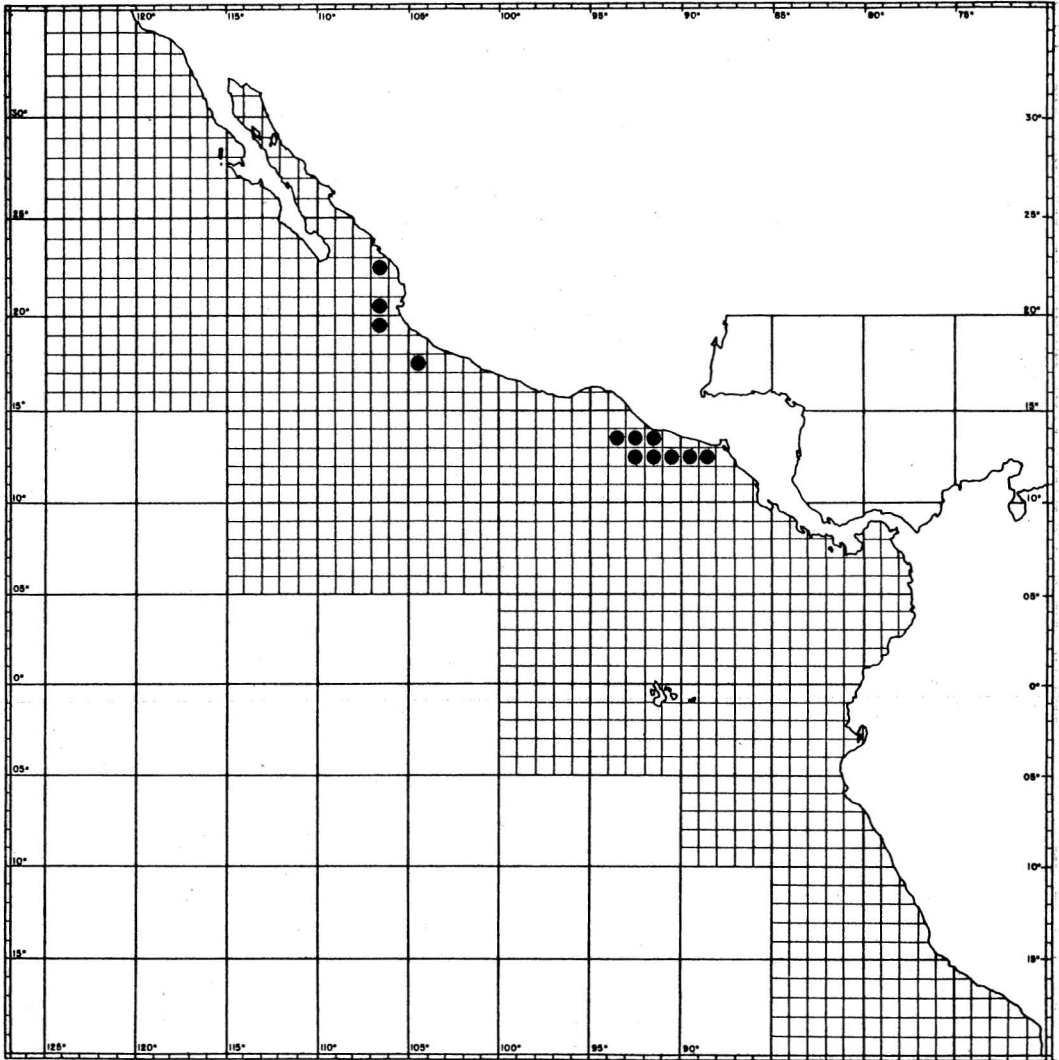


FIG. 1. Locations of capture of bobo for bait.

from 7–140 mm (Table 2). The larger specimens, over 100 mm, were captured in the vicinity of Chame Point, Panama, and San Blas, Mexico, and we believe that they are not representative of the sizes to be found in the open sea. We have no specimens of this species from the tuna bait fishery.

The bait fishery for threadfin is mostly accidental. The threadfin are encountered by chance on the tuna grounds and, if weather, bait supply, time available, etc. are favorable, the clippers

will attempt to catch them. For example, one of us (W.L.K.) in early April 1957 was aboard the clipper M/V "Mary Lou," Captain S. Parmigiani commanding, which at the time was fishing approximately 50 miles off San José, Guatemala. Numerous schools of threadfin were observed and at times scattered schools were observed as far as the eye could see. In one attempt 100 scoops<sup>3</sup> of *P. opercularis* were captured from one of these schools.

<sup>3</sup> One scoop is equal to about 8 lb of fish.

TABLE 1

LOCATION AND AMOUNTS OF BOBO TAKEN FOR USE AS TUNA BAIT, BY DATE OF CAPTURE

DATE	LOCATION		SCOOPS OF BAIT	REMARKS
29 Mar. 1953	12° 30' N	88° 47' W	60	187 specimens 46–67 mm returned, identified as <i>P. opercularis</i>
30 Nov. 1953	40–50' SW	Cape Corrientes, Mexico	700	
1 Apr. 1955	12° 05' N	88° 23' W	200	
5 Mar. 1956	12° 17' N	90° 33' W	100	
27 Aug. 1956	30–40' WSW	Cape Corrientes, Mexico	150	
2 Feb. 1957	60–70' SW	San Benito, Mexico	amount not logged	19 specimens 58–72 mm returned, identified as <i>P. opercularis</i>
2 Feb. 1957	13° 32' N	92° 54' W	60	
2 Feb. 1957	13° 58' N	93° 53' W	85	
2 Feb. 1957	13° 13' N	92° 29' W	300	
2 Feb. 1957	13° 43' N	93° 10' W	100	
3 Feb. 1957	13° 17' N	92° 26' W	410	
4 Feb. 1957	SW	San Jose, Guatemala	250	
2 Mar. 1957	12° 02' N	89° 08' W	100	
4 Mar. 1957	22° 09' N	106° 30' W	30	
5 Mar. 1957	22° 09' N	106° 30' W	48	
5 Mar. 1957	22° 09' N	106° 30' W	115	
9 Mar. 1957	22° 30' N	106° 07' W	250	with "crowder"
9 Mar. 1957	22° 09' N	106° 30' W	100	
10 Mar. 1957	22° 09' N	106° 30' W	175	
11 Mar. 1957	22° 09' N	106° 30' W	50	
11 Mar. 1957	22° 09' N	106° 30' W	65	
3 Apr. 1957	12° 30' N	91° 07' W	100	
3 Apr. 1957	13° 05' N	91° 48' W	100	Commission personnel sampled 103 specimens 63–89 mm, <i>P. opercularis</i>
4 Apr. 1957	off Acajutla, El Salvador		some bait bobo	
9 Apr. 1957	17° 38' N	104° 47' W	90	
20 Apr. 1957	17° 29' N	104° 23' W	130	

As may be seen from Figure 1 and Table 1, the catches have been centered around Cape Corrientes, Mexico, in the north and off Guatemala and El Salvador in the south. Approximately equal amounts have been taken from each locality. The only species identified has been *P. opercularis* from three samples taken off Guatemala—El Salvador. We have, therefore, definite proof of only one species that schools in large aggregations offshore. We believe, however, that *P. approximans* also schools in large aggregations as its occurrence offshore is well documented (Table 2) and threadfin in other localities, i.e., the Gulf of Mexico, are known to school offshore (Bullis, 1961).

Although the bobo is used occasionally for bait by tuna fishermen, offshore catches of this

bait fish are on the whole negligible when compared with the total bait catch. In 1957 slightly more than 2,500 scoops of threadfin were taken on the high seas as compared with the total bait catch of all bait species in the eastern Pacific of 3,700,000 scoops.

It is interesting to note that the coloration of *P. opercularis* collected off San José, Guatemala (see above), showed adaptation to the pelagic habitat from which these fish were removed. The fish were bluish-gray dorsally and whitish-silvery ventrally. We were told by some of the tuna fishermen that when the young threadfin with the bluish coloration are kept for a few days aboard the vessel in the baitwells, they assume the adult coloration, i.e., inshore coloration, which is a greenish-brown color with some

TABLE 2  
LOCATION, NUMBER, SIZE-RANGE, AND DATE OF CAPTURE OF *P. opercularis* AND  
*P. approximans* BY SCIENTIFIC PERSONNEL

DATE	LOCATION		NO. OF SPECI- MENS	SIZE-RANGE (mm) *	COLLECTOR OR REFERENCE
	Lat. N	Long. W			
<i>Polydactylus opercularis</i>					
1946	5° 52.3' S	81° 28.3'	1	?	Hildebrand (1946)
?	8° 16'	79° 37'	1	87.0	USNM No. 41218
18-III-51	13° 49'	91° 01'	3	25.0-29.0	USNM No. 181258
24-III-54	Galapagos Is., Ecuador		1	25.0	USNM No. 181257
14-IV-54	11° 43'	87° 12'	4	30.0-49.0	USNM No. 181262
1-XI-55	9° 35'	86° 17'	1	27.0	M. B. Schaefer & B. M. Shimada
6-XI-55	9° 12'	87° 06'	1	32.5	A. Ebling
2-XII-55	11° 48'	88° 25'	7	3.0-25.5	B. M. Shimada
16-I-56	5° 27' S	81° 27'	1	37.5	G. C. Broadhead & G. W. Bane
4-II-56	18° 02'	104° 02'	1	58.0	J. A. Renner & R. Hark
11-III-56	21° 05'	106° 43'	10	28.0-39.0	C. J. Orange
11-III-56	21° 05'	106° 43'	92	25.0-65.0	C. J. Orange
25-IV-56	12° 08'	88° 12'	5	18.0-28.0	?
9-V-56	16° 16'	100° 19'	2	20.0-24.0	USNM No. 181254
11-VI-56	SE Is. Cleopha, Tres Marias		1	20.0	USNM No. 181274
4-XI-56	20° 53'	106° 28'	1	44.0	Fish & Wildlife Service
4-II-57	18° 02'	104° 02'	1	57.0	J. A. Renner & R. Hark
13-II-57	22° 26'	106° 06'	48	21.0-53.0	J. A. Renner & R. Hark
9-IV-57	12° 22'	87° 39'	7	18.5-39.5	C. J. Orange
17-IV-57	12° 57'	89° 55'	3	38.0-40.0	C. J. Orange & P. N. Sund
18-IV-57	3° 03'	89° 52'	40	21.0-51.5	C. J. Orange & P. N. Sund
23-IV-57	6° 36'	78° 14'	4	17.0-23.0	W. L. Klawe
16-VI-57	6° 18'	77° 47'	3	26.5-42.5	F. M. Larmie & R. Kirschman
10-VI-58	0° 22' S	80° 50'	4	15.0-19.1	C. L. Peterson & R. Hetzler
11-VI-58	17° 36.5'	102° 23'	1	32.0	W. L. Klawe
15-VI-58	21° 37'	106° 31.5'	4	7.0-21.0	W. L. Klawe
18-VI-58	0° 22' S	80° 50'	4	16.0-29.0	C. L. Peterson & R. Hetzler
22-VI-58	2° 01' S	81° 01'	2	21.0, 22.0	C. L. Peterson & R. Hetzler
7-II-59	12° 41'	91° 35'	1	30.0	R. C. Hennemuth
14-II-59	15° 00'	93° 00'	3	44.0, 45.0, 46.0	P. N. Sund
19-III-59	23° 55'	108° 00'	9	24.5-27.5	?
10-XI-59	18° 56'	104° 10'	1	43.0	?
22-III-60	20° 34'	105° 54'	6	16.5-32.5	IATTC tagging cruise
20-VII-60	9° 21'	85° 07'	1	22.0	H. Sobrado
21-VII-60	9° 21'	85° 07'	1	10.0	H. Sobrado
14-IV-61	19° 06'	105° 19'	9	20.5-31.5	F. J. Hester & R. R. Whitney
25-26-III-62	11° 34.4'	87° 00'	1	19.0	W. L. Klawe
27-III-62	10° 24'	85° 53'	1	28.0	W. L. Klawe
?	6° 46'	78° 00'	1	34.0	R. C. Griffiths & D. R. Pruden
<i>Polydactylus approximans</i>					
VIII-07	Taboga Is., Panama		1	27.0	USNM No. 62925
VII-12	Chame Pt., Panama		2	30.0, 32.0	USNM No. 82027
8-III-13	Chame Pt., Panama		3	20.0-37.0	USNM No. 82195
26-VII-13	Chame Pt., Panama		20+	22.0-110.0	USNM No. 82193
? 1913	Chame Pt., Panama		1	55.0	USNM No. 82194
1946	5° 52.3' S	81° 28.3'	1	?	Hildebrand (1946)

\* Fish measured from tip to snout to the shortest median ray in caudal fin.

TABLE 2 (continued)

DATE	LOCATION		NO. OF SPECIMENS	SIZE-RANGE (mm) *	COLLECTOR OR REFERENCE
	Lat. N	Long. W			
31-III-50	Near Tres Marias		1	35.0	W. Richards
30-VII-52	9° 55'	84° 50'	7	55.0-62.0	USNM No. 181276
27-IX-52	26° 03'	112° 15'	11	41.0-63.0	Fish & Wildlife Service
28-III-54	6° 50'	78° 07'	20	12.0-41.0	?
1-XI-55	9° 35'	86° 17'	16	18.0-23.0	M. B. Schaefer & B. M. Shimada
6-XI-55	9° 12'	87° 06'	14	20.0-33.0	A. Ebling
11-XI-55	7° 58'	84° 10'	2	31.0, 33.0	A. Ebling
13-XI-55	4° 03'	80° 46'	1	13.0	A. Ebling
13-XI-55	4° -2'	79° 46'	1	32.0	A. Ebling
19-XI-55	7° 4'-	79° 23'	21	14.0-36.0	A. Ebling
2-XII-55	11° 48'	88° 25'	21	19.0-39.5	B. M. Shimada
7-XII-55	10° 02'	89° 06.5'	1	43.0	B. M. Shimada
29-XII-55	3° 31' S	81° 10'	1	17.0	G. C. Broadhead & G. W. Bane
14-I-56	5° 13' S	81° 30'	5	16.0-20.0	G. C. Broadhead & G. W. Bane
14-I-56	5° 13' S	81° 30'	4	15.0-23.0	G. W. Bane
16-I-56	5° 27' S	81° 27'	76	21.0-30.5	G. C. Broadhead & G. W. Bane
21-I-56	11° 58'	91° 30'	8	15.0-32.0	USNM No. 177788
11-III-56	21° 05'	106° 43'	64	25.0-37.0	C. J. Orange
11-III-56	21° 05'	106° 43'	540	20.5-39.0	C. J. Orange
23-III-56	15° 24'	97° 20'	1	35.0	USNM No. 177789
25-III-56	12° 08'	88° 12'	47	12.0-27.0	?
17-IX-56	23° 37'-	110° 37'	1	39.0	W. L. Klawe
28-IX-56	13° 47'	93° 02'	10	20.5-29.0	W. L. Klawe
30-IX-56	13° 49'	92° 44'	2	22.0-30.5	W. L. Klawe
4-X-56	13° 19'	93° 33'	5	24.0-27.0	W. L. Klawe
4-XI-56	23° 48'	112° 02'	3	30.5-32.0	W. L. Klawe
21-I-57	21° 02'	106° 14'	3	25.0-37.0	USNM No. 181280
12-II-57	0° 34' S	80° 56'	1	40.0	USNM No. 177778
13-II-57	22° 26'	106° 06'	40	14.0-27.0	J. A. Renner & R. Hark
24-II-57	12° 07'	91° 20'	3	21.0-24.0	C. J. Orange & P. N. Sund
25-II-57	12° 59'	92° 02'	3	26.0-36.0	C. J. Orange & P. N. Sund
16-III-57	13° 12'	90° 40'	1	38.0	C. J. Orange
31-III-57	15° 11'	92° 25'	5	24.0-33.0	W. L. Klawe
4-IV-57	12° 34'	91° 38'	1	23.0	W. L. Klawe
6-IV-57	12° 47'	91° 42'	1	22.0	W. L. Klawe
8-IV-57	13° 13'	89° 54'	5	22.0-36.5	W. L. Klawe
9-IV-57	12° 22'	87° 39'	72	15.5-27.5	C. J. Orange
12-IV-57	12° 03'	89° 44.5'	2	20.0-21.0	W. L. Klawe
14-IV-57	12° 21'	90° 43'	1	25.0	USNM No. 181256
17-IV-57	12° 57'	89° 55'	2	26.0-32.5	C. J. Orange & P. N. Sund
18-IV-57	13° 03'	89° 52'	22	12.0-29.5	C. J. Orange & P. N. Sund
23-IV-57	6° 36'	78° 14'	13	13.0-22.0	W. L. Klawe
24-IV-57	6° 18'	77° 54'	26	14.0-24.5	W. L. Klawe
25-IV-57	6° 35'	78° 03'	4	13.5-46.0	W. L. Klawe
28-IV-57	6° 25'	78° 28'	24	18.0-34.0	W. L. Klawe
29-IV-57	6° 46'	78° 00'	5	32.5-44.0	W. L. Klawe
2-V-57	6° 42'	78° 56'	1	43.0	W. L. Klawe
8-VI-57	7° 05'	78° 09'	1	38.0	F. M. Larmie & R. Kirschman
15-VI-57	6° 11'	77° 43'	2	23.0	F. M. Larmie & R. Kirschman
17-VI-57	6° 57'	78° 18'	12	16.5-33.0	F. M. Larmie & R. Kirschman
23-VI-57	6° 20'	77° 35'	2	36.0-36.5	F. M. Larmie & R. Kirschman
25-VI-57	6° 24'	77° 44'	4	26.0-34.5	F. M. Larmie & R. Kirschman
27-VI-57	15° 05'	93° 59'	4	18.0-28.0	W. L. Klawe
2-VII-57	6° 14'	80° 32'	12	25.0-34.0	W. L. Klawe

TABLE 2 (continued)

DATE	LOCATION		NO. OF SPECI- MENS	SIZE-RANGE (mm) *	COLLECTOR OR REFERENCE
	Lat. N	Long. W			
16-VII-57	23° 09'	111° 15'	3	18.5-20.0	W. L. Klawe & R. C. Hennemuth
12-VIII-57	0° 49'	91° 95'	1	25.5	F. G. Alverson
13-VIII-57	25° 56'	110° 59'	1	30.0	Fish & Wildlife Service
21-VIII-57	25° 20'	112° 45.5'	2	14.0-20.0	A. M. Vrooman
25-VIII-57	27° 38'	114° 50'	1	30.0	A. M. Vrooman
25-I-58	21° 10'	105° 15'	3	31.0-35.0	USNM No. 181277
6-II-58	21° 32'	105° 19'	8	64.0-109.0	USNM No. 181294
?-II-58	21° 13'	105° 15'	1	30.0	USNM No. 181302
12-V-58	9° 08'	90° 12'	1	38.0	W. L. Klawe
19-V-58	5° 29'	77° 57'	2	52.5-59.0	W. L. Klawe
20-V-58	7° 24'	78° 49'	5	37.0-47.0	W. L. Klawe
27-V-58	12° 22'	90° 06'	2	52.5-59.0	W. L. Klawe
29-V-58	14° 47'	94° 21'	2	21.5-23.5	W. L. Klawe
31-V-58	15° 15'	95° 22.5'	3	16.0-20.0	W. L. Klawe
10-VI-58	0° 22' S	80° 50'	1	12.5	C. L. Peterson & R. Hetzler
15-VI-58	21° 37'	106° 31.5'	556	6.0-33.0	W. L. Klawe
15-16-VI-58	21° 36'	106° 44'	94	20.5-40.0	W. L. Klawe
22-VI-58	2° 01' S	81° 01'	5	13.0-21.0	C. L. Peterson & R. Hetzler
6-9-IX-58	Chame Pt., Panama		51	75.0-140.0+	USNM No. 177818
9-XI-58	14° 30'	95° 00'	2	46.0-46.5	E. Forsbergh & D. Reith
28-I-59	15° 45'	97° 05'	1	39.0	R. C. Hennemuth
16-II-59	17° 47'	103° 14'	4	9.0 ea	R. C. Hennemuth & P. N. Sund
24-II-59	9° 12'	85° 15'	8	11.5-26.5	H. Sobrado
25-II-59	9° 17'	85° 13'	6	14.0-22.5	H. Sobrado
12-III-59	9° 28'	85° 11'	3	13.0-18.0	H. Sobrado
13-III-59	23° 13'	107° 11'	1	38.0	C. J. Orange
19-III-59	23° 55'	108° 00'	4	10.0-22.0	?
7-V-59	9° 24'	85° 13'	19	20.0-28.5	H. Sobrado
8-V-59	9° 24'	85° 13'	1	7.0	H. Sobrado
12-V-59	5° 35'	81° 28'	1	38.0	W. L. Klawe
8-VI-59	19° 05'	105° 20'	1	35.0	IATTC tagging cruise
10-XI-59	18° 56'	104° 10'	2	23.0 ea	IATTC tagging cruise
24-XI-59	9° 12'	85° 15'	1	48.0	H. Sobrado
24-II-60	9° 12'	85° 15'	8	11.5-26.5	H. Sobrado
25-II-60	9° 17'	85° 13'	6	14.0-22.5	H. Sobrado
22-III-60	20° 42'	105° 52'	14	13.0-38.0	?
30-III-60	9° 21'	85° 07'	4	12.0-15.0	H. Sobrado
23-V-60	9° 11'	85° 07'	22	12.0-23.0	H. Sobrado
24-V-60	9° 21'	85° 07'	4	12.5-27.0	H. Sobrado
20-VII-60	9° 21'	85° 07'	10	24.5-27.5	H. Sobrado
21-VII-60	9° 21'	85° 07'	7	16.0-18.0	H. Sobrado
17-VIII-60	9° 11'	85° 07'	4	19.0-39.5	H. Sobrado
20-X-60	9° 21'	85° 07'	2	13.0-25.5	H. Sobrado
12-13-XI-60	9° 11'	85° 07'	4	21.0-24.0	H. Sobrado
14-IV-61	19° 06'	105° 19'	17	24.0-53.0	F. J. Hester & R. R. Whitney
27-III-62	10° 28'	86° 02'	50	12.0-29.0	W. L. Klawe
2-IV-62	0° 04'	80° 54'	9	16.0-47.0	W. L. Klawe
3-IV-62	0° 04'	80° 54'	1	19.0	W. L. Klawe
6-IV-62	1° 56' S	81° 13'	1	38.0	W. L. Klawe
6-IV-62	0° 22' S	80° 50'	2	40.0, 46.0	W. L. Klawe
16-IV-62	0° 06'	80° 32'	1	9.0	W. L. Klawe
29-IV-62	12° 06.5'	87° 07.7'	11	14.0-57.0	W. L. Klawe
?	Chame Pt., Panama		10	4.5-14.0	USNM No. 79865-7
?	2° 58'	78° 13'	1	20.0	USNM No. 101631

yellow in the ventral and in the entire caudal region.

In still another respect young threadfin caught in the pelagic situation exhibit marks of that habitat. Young *P. opercularis* collected off the Tres Marias Islands, Mexico, were infested with juvenile stages of the parasitic copepod *Caligus coryphaene* (Shiino, 1959). The regular hosts of this parasite are usually such pelagic fishes as the dolphin, various tunas, and the bonito, to mention a few.

Numerous predators, besides man, take advantage of the aggregations of threadfin found offshore. Skipjack (*Katsuwonus pelamis*), yellowfin tuna (*Thunnus macropterus*), sailfish, sharks, and oceanic birds were observed (by W.L.K.) feeding on the threadfin some 50 miles off San José, Guatemala, in April 1957. We have been informed that the crew of the clipper M/V "Commander" observed whales feeding on schools of threadfin 40 miles WSW of Cape Corrientes, Mexico, in August 1957.

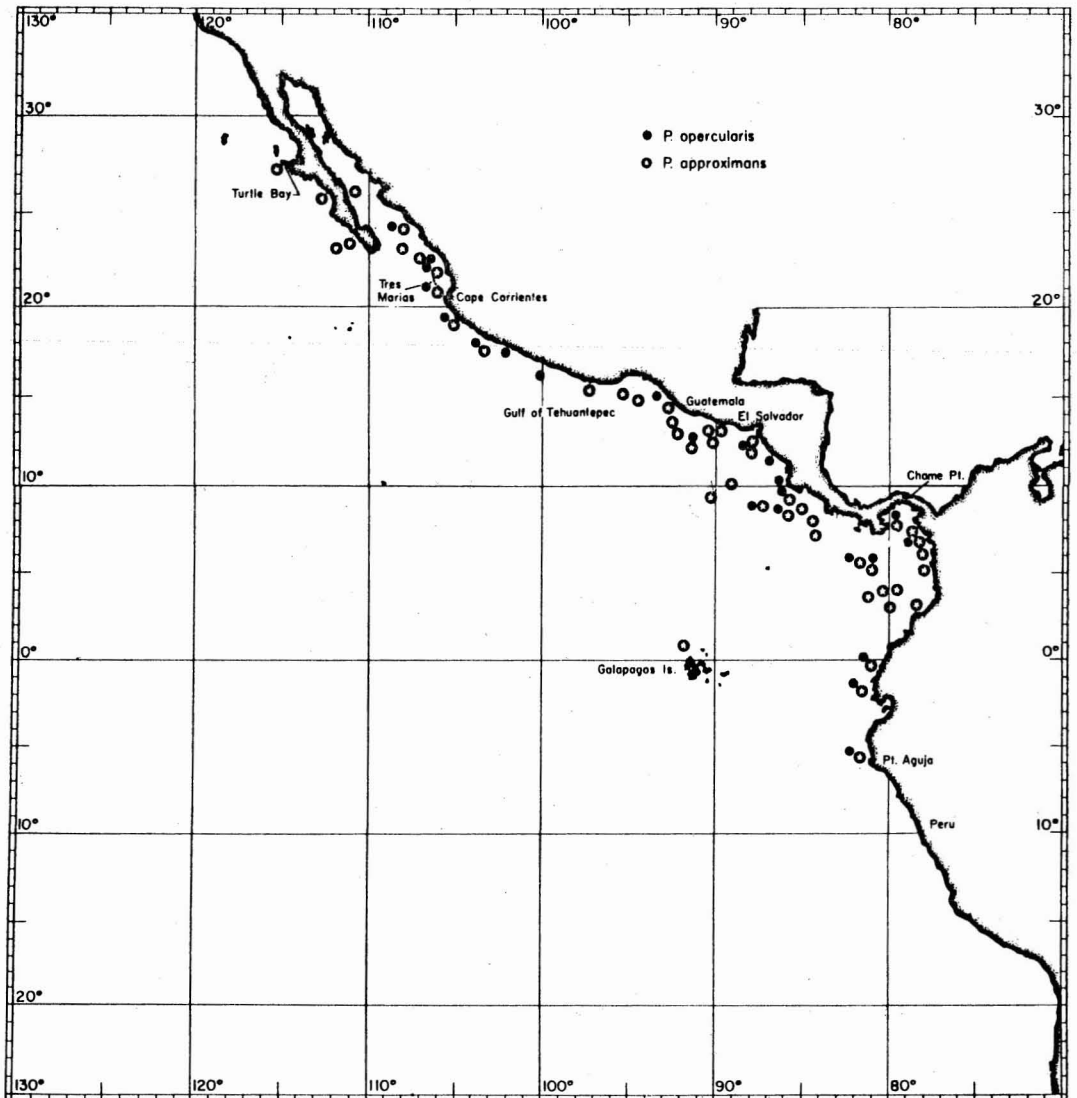


FIG. 2. Locations of capture of bobo by scientific personnel.

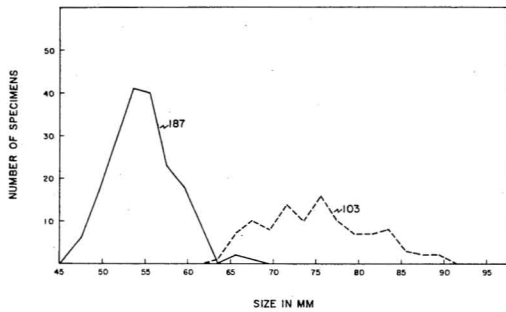


FIG. 3. Length frequency distribution of two samples of *P. opercularis* captured on the high seas for use as tuna bait.

It would be reasonable to assume that the presence of young of small size (for our purposes less than 40 mm) is an indication of recent spawning. We have arbitrarily divided the eastern Pacific into three geographical areas, north of the Gulf of Tehuantepec, Central America, and South America, and plotted the occurrence of small fish for each species, by month, regardless of the year of collection.

It appears that *P. approximans* spawns throughout the year in all three areas. Most likely the same applies to *P. opercularis*, although the evidence is not as strong as that for *approximans*. It should be noted, however, that the number of *P. opercularis* in our collection is smaller than that of *P. approximans*. The fact that one of the species definitely and the other most likely spawns throughout the year is of no surprise, as *P. indicus* in the region of Bombay, India, has a spawning season extending through the entire year (Karekar and Bal, 1960).

## REFERENCES

- ALVERSON, F. G., and B. M. SHIMADA. 1957. A study of the eastern Pacific fishery for tuna baitfishes, with particular reference to the anchoveta (*Cetengraulis mysticetus*). Inter-Amer. Trop. Tuna Comm., Bull. 2(2):25-61 (English), 62-79 (Spanish).
- BERDEGUÉ, A. JULIO. 1956. Peces de importancia comercial en la costa noroccidental de México. Comisión para el fomento de la Piscicultura Rural. 345 pp.
- BULLIS, H. R., JR. 1961. Observations on the feeding behaviour of white-tip sharks on schooling fishes. Ecology, 42(1):194-195.
- GODSIL, H. C. 1938. The high seas tuna fishery of California. Calif. Div. Fish and Game, Fish Bull. 51:41.
- HILDEBRAND, S. F. 1946. A descriptive catalog of the shorefishes of Peru. U. S. Nat. Mus., Bull. 189:530.
- KAREKAR, P. S., and D. V. BAL. 1960. A study on maturity and spawning of *Polydactylus indicus* (Shaw). Indian Jour. Fish. 7(1):147-164.
- KLAWE, W. L. 1963. Observations on the spawning of four species of tuna (*Neothunnus macropterus*, *Katsuwonus pelamis*, *Auxis thazard* and *Euthynnus lineatus*) in the eastern Pacific Ocean, based on the distribution of their larvae and juveniles. Inter-Amer. Trop. Tuna Comm., Bull. 6(9):447-514.
- SHINO, S. M. 1959. Ostspazifische parasitierende Copepoden. Report Facul. Fish. Prefect. Univ. Mie 3(2):267-333.

*P. approximans*

	J	F	M	A	M	J	J	A	S	O	N	D
North of Gulf of Tehuantepec	×	×	×	×	—	×	×	×	×	×	×	×
Central America	×	×	×	×	×	×	×	×	×	×	×	×
South America	×	×	×	×	—	×	×	×	—	—	×	×
Composite all areas	×	×	×	×	×	×	×	×	×	×	×	×

*P. opercularis*

	J	F	M	A	M	J	J	A	S	O	N	D
North of Gulf of Tehuantepec	—	×	×	×	×	×	×	—	—	—	×	—
Central America	—	—	×	×	—	×	—	—	—	—	×	×
South America	×	—	×	—	—	×	—	—	—	—	—	—
Composite all areas	×	×	×	×	×	×	×	—	—	—	×	×