OCCURRENCE, MOVEMENTS, AND DISTRIBUTION OF BOTTLENOSE DOLPHIN, *TURSIOPS TRUNCATUS*, IN SOUTHERN TEXAS

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ABSTRACT

Boat and land observations of free-ranging bottlenose dolphins, *Tursiops truncatus*, near Port Aransas, Texas, provided data on seasonal occurrence, daily movements, and individual distribution patterns. Censuses revealed that the winter population in the study area was twice the size of the summer population. Individual dolphins were variously identified as summer residents, winter residents, or year-round residents in the study area. There was a significant relationship between dolphin movements and tide in some sections of the study area. Dolphins consistently moved against the ebb tide and sometimes against the flood tide in these sections. Time of day was significantly related to dolphin movements in a few sections of the study area. Part or all of the study area was included in the home ranges of several individually recognizable dolphins.

Only three long-term studies of free-ranging Atlantic bottlenose dolphins, *Tursiops truncatus*, have been conducted (Würsig and Würsig 1977, 1979; Hogan[2]; Irvine et al.[3]). Bottlenose dolphins in Texas have been studied only opportunistically by Gunter (1942, 1943, 1951). Lack of detailed information on free-ranging *T. truncatus* provided an incentive for a 1-yr study of bottlenose dolphins in southern Texas. This paper presents data on seasonal occurrence, daily movements, and individual distribution patterns of dolphins in the study area.

METHODS

The study area was located near Port Aransas, Texas, (lat. 27°50′15″ N; long. 97°02′45″ W) and included seven sections (Figure 1). Aransas Pass is the shipping outlet into the Gulf of Mexico for the Port of Corpus Christi. The next open pass through which dolphins could enter or leave the Gulf is Cedar Bayou, a natural pass, located 37 km to the northeast. Sections 1, 2, and 6 are dredged to a depth of 14 m and are all used by large tankers and a variety of other boats. Sections 3 and 7 are dredged to a depth of 5 m and are used by commercial and sport fishing boats, barges, and pleasure boats. Sections 4 and 5 average 2-3 m deep and are frequented only by small fishing boats. The entire study area covers approximately 34 km^2.

Between 1 June 1976 and 31 May 1977, I spent 1,065 h observing dolphins, either from a 4 m Boston Whaler[4] or from land. Opportunistic observations were made from June through December 1977. Uniquely marked dorsal fins (Würsig and Würsig 1977) were used to identify 21 individual dolphins, and these individuals provided information on distribution and seasonal movements.

I defined the seasons as follows: 1) summer, June-August; 2) fall, September-November; 3) winter, December-February; 4) spring, March-May. Initially, air and water temperatures from the U.S. Coast Guard Station at Port Aransas were used, but after 1 December 1976 I collected these data at the beginning of each day in a harbor off Aransas Pass. Mean air and water temperatures were 28.2° and 28.4° C for summer 1976, 18.7° and 18.8° C for fall 1976, 11.2° and 11.4° C for winter 1976-77, and 22.5° and 22.7° C for spring 1977.

Zigzag censuses, conducted an average of four times (range = 0-9) per month in each section of the study area, were used to estimate population size. A zigzag census was conducted by piloting the

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[2]Hogan, T. 1975. Untitled draft of M.S. thesis. Unpubl. manuscr., 42 p. Univ. Rhode Island, Kingston.

[3]Irvine, A. B., M. D. Scott, R. S. Wells, J. H. Kaufmann, and W. E. Evans. 1979. A study of the activities and movements of the Atlantic bottlenosed dolphin, *Tursiops truncatus*, including an evaluation of tagging techniques. Available National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22151 as PB-298 042.

[4]Reference to trade names does not imply endorsement by the National Marine Fisheries Service, NOAA.

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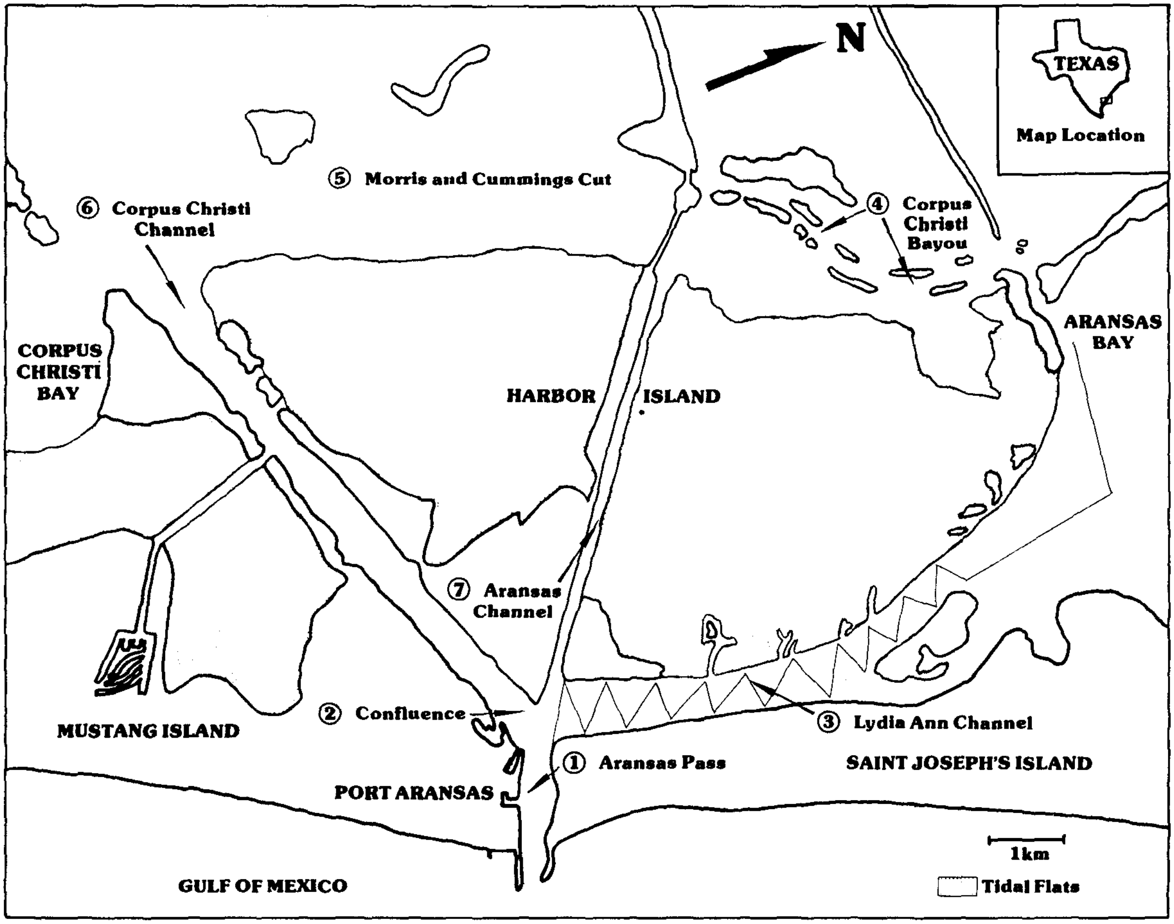

FIGURE 1.—Bottlenose dolphin study area near Port Aransas, Texas. Circled numbers designate the seven sections of the study area: 1) Aransas Pass, 2) the Confluence, 3) Lydia Ann Channel, 4) Corpus Christi Bayou, 5) Morris and Cummings Cut, 6) Corpus Christi Channel, and 7) Aransas Channel. The boundaries of the study area are the ends of the jetties at the southeast end of section 1, the mouth of Aransas Bay to the northeast, the mouth of Corpus Christi Bay to the southwest, and the islands along the northwest border of sections 4 and 5. The zigzag line drawn through section 3 shows the path followed while conducting zigzag censuses of dolphins. Similar paths were followed while censusing dolphins in the other sections.

boat at slow speed back and forth through a section and counting all dolphins sighted (Figure 1). A total of 335 zigzag censuses was conducted during 201 h during the 1-yr study. The average time per census was 23.9 min for Aransas Pass, 11.0 min for the Confluence, 55.7 min for Lydia Ann Channel, 28.3 min for Corpus Christi Bayou, 63.5 min for Morris and Cummings Cut, 52.6 min for Corpus Christi Channel, and 25.6 min for Aransas Channel.

Data on direction of dolphin movement, tidal state, and time of day were used to identify daily movement patterns. The terms used to describe direction of movement in sections 1, 3, and 6 are "up" for movement toward the bays and "down" for movement toward the Gulf of Mexico. Time of day is divided into three periods: early (0700-0900 h), midday (1000-1300 h), and late (1400-1900 h). Very few observations were made from 2000 to 0600 h, so this time period is not considered. The chi-square test was used to determine whether there was a significant relationship between dolphin movements and tide and time of day. When a relationship was found to be significant ($P<0.01$), the strength of the relationship was measured by Cramer's V (Nie et al. 1970).

RESULTS

Seasonal Occurrence

Seasonal occurrence patterns were derived from seasonal variation in dolphin numbers and from observations of individual dolphins. The monthly mean number of dolphins in the study area varied from a low of 48 in October (range = 8-104) (the September low is inaccurate because no zigzag censuses were conducted in some sections) to a high of 164 in January (range = 65-281) (Figure 2). Dolphin abundance declined from summer to fall, rose in the winter, and declined again in the spring. Boat and land observations from August through December 1977 showed the same pattern as the previous fall and early winter: dolphin numbers declined noticeably in early fall and then increased to higher than summer numbers in November and December.

Sightings of identifiable dolphins confirmed a seasonal occurrence in the study area. Sixteen of the 19 recognizable dolphins in the study area were seen on 5 or more days and were identified by the fifth month of the study. The other three dolphins were seen on <5 d or were not identified until the eighth month of the study. Three patterns of seasonal occurrence in the study area were demonstrated by the 16 dolphins (Table 1). Four individuals (Thick Fin, Jagger, Notched Fin, and Short Triangle) were predominantly spring and summer residents: over 60% of the days each was seen in the study area occurred during spring and summer and <40% occurred during fall and winter. Five individuals (Lumpy, Cloud, Bent Fin, Twin, and Tiki) were predominantly fall and winter residents: over 60% of the days each was seen in the study area occurred during fall and winter and <40% occurred during spring and summer. The remaining seven dolphins spent approximately the same amount of time in the study area during spring and summer as during fall and winter.

My observations from June through December 1977 confirmed the seasonal occurrence pattern of some dolpins established during the 1-yr study. Lumpy, a fall and winter resident who had been seen only between 20 November 1976 and 2 February 1977, was seen again on 1 and 3 December 1977. Bent Fin, a fall and winter resident who was seen regularly from October 1976 through February 1977 and then only on 3 d through November 1977, was again sighted in the study area on 5 and 8 December 1977. I saw Thick Fin (spring and summer resident) in the study area frequently from June 1977 to 8 September 1977 but never after that through December 1977, when I left the

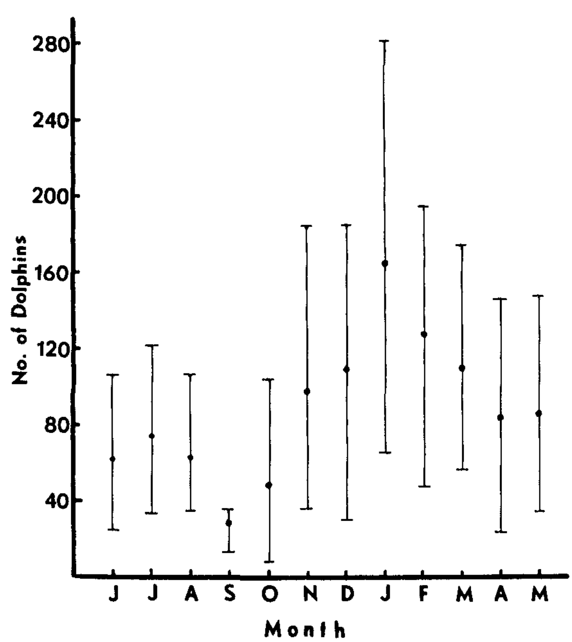

FIGURE 2.—Mean number of Atlantic bottlenose dolphins counted in the study area near Port Aransas, Texas, for each month from June 1976 through May 1977. Ranges are indicated by the vertical lines. The September count is unreliable because an insufficient number of censuses were conducted that month.

TABLE 1.—Seasonal occurrence of 16 bottlenose dolphins in the Port Aransas, Texas, area. Percentage of days each dolphin was seen during each season and each spring and summer (Sp/S) period and fall and winter (F/W) period are given. Individual dolphin occurrence patterns suggested the spring-summer and fall-winter links. Dashes indicate that the dolphin was not identified until after that season.

Dolphin	Total days sighted	Percentage of total days					
		Sp	S	F	W	Sp/S	F/W
Thick Fin	70	36	46	17	1	82	18
Jagger	5	20	60	20	0	80	20
Notched Fin	9	0	67	22	11	67	33
Short Triangle	86	31	35	29	5	66	34
Lumpy	10	0	—	30	70	0	100
Cloud	23	9	13	22	57	22	79
Bent Fin	38	5	18	24	53	23	77
Twin	13	31	—	15	54	31	69
Tiki	28	29	7	18	46	36	64
Nicky	8	25	25	0	50	50	50
Trigger	18	50	—	28	22	50	50
Chopper	46	24	24	22	30	48	52
Teaser	27	48	—	19	33	52	48
Raggedy Ann	33	33	12	12	42	45	54
V-Tip	9	44	11	33	11	55	44
Snaggle Tooth	21	33	24	24	19	57	43

area. Poff[5] reported that Thick Fin remained predominantly a spring and summer resident and Bent Fin primarily a fall and winter resident in the study area through midsummer 1979.

Daily Movements

Field observations indicated that tide and time of day influenced the movement patterns of dolphins in some sections of the study area. Most apparent was the tendency of dolphins in the lower sections of the study area (1, 3, and 6 on Figure 1) to move up against an ebb tide. The most apparent time of day effect occurred in Morris and Cummings Cut (section 5) where dolphins moved northward early in the day, all directions at midday, and southward late in the day.

The chi-square test showed that tide and direction of movement were significantly related ($P<0.0001$) in the lower section of the study area (sections 1, 3, and 6 combined) at three separate periods of the day (early, midday, late) and at all times of day combined. At all time periods most dolphins moved up during ebb tide. During flood tide most dolphins moved down, although many moved across the channel or randomly. The association between tide and direction of movement was strongest early ($V = 0.513$) and weakest at midday ($V = 0.297$) with intermediate values late ($V = 0.410$) and at all times combined ($V = 0.407$). Direction of movement and tide were significantly related in four of the six sections of the study area considered (Table 2).

The relationship between direction of movement and time of day also proved significant in four out of six sections under some conditions (Table 3). The observations on dolphin movements in Morris and Cummings Cut were quantitatively confirmed, and the association between direction of movement and time of day was stronger in that section than in any other section (see Cramer's V values in Table 3).

The frequency of sightings of groups of dolphins was calculated for all of the conditions presented in Tables 2 and 3. In all cases where the relationship between the variables was significant (chi-square $P<0.01$), the group sighting data conformed with the individual sighting data.

Individual Distribution Patterns

Sightings of each recognizable individual were confined to a specific portion of the study area rather than distributed randomly throughout the

[5]M. Poff, Research Assistant, University of Texas, Marine Science Institute, Port Aransas, TX 78373, pers. commun. July 1979. (Deceased.)

TABLE 2.—Relationship between direction of movement and tide proved significant (chi-square $P<0.01$) in four sections of the Port Aransas, Texas, study area at certain times of day. Numbers in the table represent frequency of individual dolphin sightings. Cramer's V indicates strength of the relationship between the two variables, and each V is comparable with every other V.

	Tidal stages at selected times of day							
	Early		Midday		Late		All times	
Section	Ebb	Flood	Ebb	Flood	Ebb	Flood	Ebb	Flood
Aransas Pass (1) direction:								
Up	613	54	347	56	182	83	1,165	194
Down	65	200	179	80	35	74	283	357
Across/random	126	153	92	31	27	43	245	227
Chi-square	459.06		28.53		50.73		422.07	
Cramer's V	0.616		0.191		0.338		0.413	
Corpus Christi Channel (6) direction:								
Up	513	77	205	186	296	153	1,035	416
Down	86	202	70	360	33	227	192	789
Across/random	305	226	191	348	123	228	632	802
Chi-square	291.02		119.36		203.15		642.81	
Cramer's V	0.454		0.296		0.438		0.408	
Lydia Ann Channel (3) direction:								
Up	329	57	380	93	20	21	729	171
Down	13	47	59	48	5	27	77	126
Across/random	114	58	178	44	6	25	298	127
Chi-square	115.43		33.05		11.749		154.59	
Cramer's V	0.432		0.203		0.336		0.318	
Morris and Cummings Cut (5) direction:								
North	30	28	Not		12	9	149	153
South	0	16	significant		0	99	165	250
Across/random	33	0			0	10	146	112
Chi-square	[1]47.183				[1]68.620		18.90	
Cramer's V	[1]0.664				[1]0.727		0.139	

[1]Insufficient data in a given case made the chi-square test potentially invalid.

TABLE 3.—Relationship between direction of dolphin movement and time of day was significant (chi-square $P<0.01$) in four sections of the Port Aransas, Texas, study area during a few tidal stages. Numbers in the table represent frequency of individual dolphin sightings. Cramer's *V* indicates the strength of the relationship between the two variables, and each *V* is comparable with every other *V*.

	Time of day at selected tidal stages								
	Ebb			Flood			All tides		
Section	Early	Midday	Late	Early	Midday	Late	Early	Midday	Late
Aransas Pass (1) direction:									
Up	613	347	182	54	56	83	740	501	390
Down	65	179	35	200	80	74	398	386	175
Across/random	126	92	27	153	31	43	385	165	148
Chi-square	116.78			73.97			62.41		
Cramer's *V*	0.187			0.219			0.097		
Corpus Christi Channel (6) direction:									
Up	513	205	296	77	186	153	775	567	648
Down	86	70	33	202	360	227	506	724	310
Across/random	305	191	123	226	348	228	781	763	501
Chi-square	46.74			18.029			145.71		
Cramer's *V*	0.113			0.067			0.114		
Lydia Ann Channel (3) direction:									
Up	329	380	20	57	93	21	494	750	72
Down	13	59	5	47	48	27	125	190	60
Across/random	114	178	6	58	44	25	260	425	90
Chi-square	[1]27.335			14.717			49.50		
Cramer's *V*	[1]0.111			0.132			0.100		
Morris and Cummings Cut (5) direction:									
North	30	107	12	28	116	9	330	857	54
South	0	165	0	16	135	99	85	684	537
Across/random	33	113	0	0	102	10	182	1,038	165
Chi-square	[1]69.059			104.46			737.32		
Cramer's *V*	[1]0.274			0.318			0.306		

[1]Insufficient data in a given case made chi-square test potentially invalid.

study area. Thick Fin and Raggedy Ann used separate but adjacent portions of the study area (Figure 3). Teaser used a portion of the study area which included most of Thick Fin's portion and all of Raggedy Ann's portion (Figure 3).

The portions of the study area used by Thick Fin and Raggedy Ann were designated Region A and Region B. Region A encompassed Aransas Pass, the Confluence, Lydia Ann Channel, and Corpus Christi Channel. Five dolphins, including Thick Fin, were sighted 80% or more of the time in this region (Table 4). Region B covered Morris and Cummings Cut, and three dolphins, including Raggedy Ann, were seen 88% or more of the time there (Table 4). These three Region B dolphins consistently traveled in a large group of usually 20 or more dolphins which moved into and out of the study area through Corpus Christi Bay. Two dolphins, Teaser and Cloud, were observed often in both Regions A and B, and their sightings covered 20 km^2 and 25 km^2.

In addition to the 19 identifiable dolphins in the study area, two recognizable individuals, Southpaw and Half Fin, were sighted only in the Gulf of Mexico. Other dolphins with unique dorsal fins were seen in the gulf whenever observations were made there. These *T. truncatus* from the Gulf of Mexico were sometimes seen within meters of Aransas Pass, but they entered the study area only rarely and briefly.

As discussed earlier, many dolphins inhabited the study area on a seasonal basis. Observations of some individuals indicated their possible locations when they left the study area. On 22 February 1977 I saw Short Triangle traveling up Aransas Pass toward the bays at 11:07 a.m. and traveling down the Pass to the Gulf at 12:35 p.m. Although I made continuous observations for the remainder of the day from the shoreline of the Pass, I did not resight Short Triangle. On 18 October 1976 I saw Thick Fin entering the Gulf of Mexico; after that and until mid-March 1977, I saw Thick Fin only on 18 November 1976 and 25 January 1977. On 29 June 1979, Gruber[6] sighted Thick Fin 50 m off the Port O'Connor, Texas, jetties in the Gulf of Mexico, 100 km northeast of Port Aransas. I was able to confirm the sighting from photographs taken by Gruber. Port Aransas ferry operators, familiar with Thick Fin, reported to Gruber that they had seen Thick Fin on 24 June and again on 22 July. Bent Fin entered and left the study area through

[6]J. Gruber, graduate student, Department of Wildlife and Fishery Sciences, Texas A&M University, College Station, TX 77843, pers. commun. July 1979.

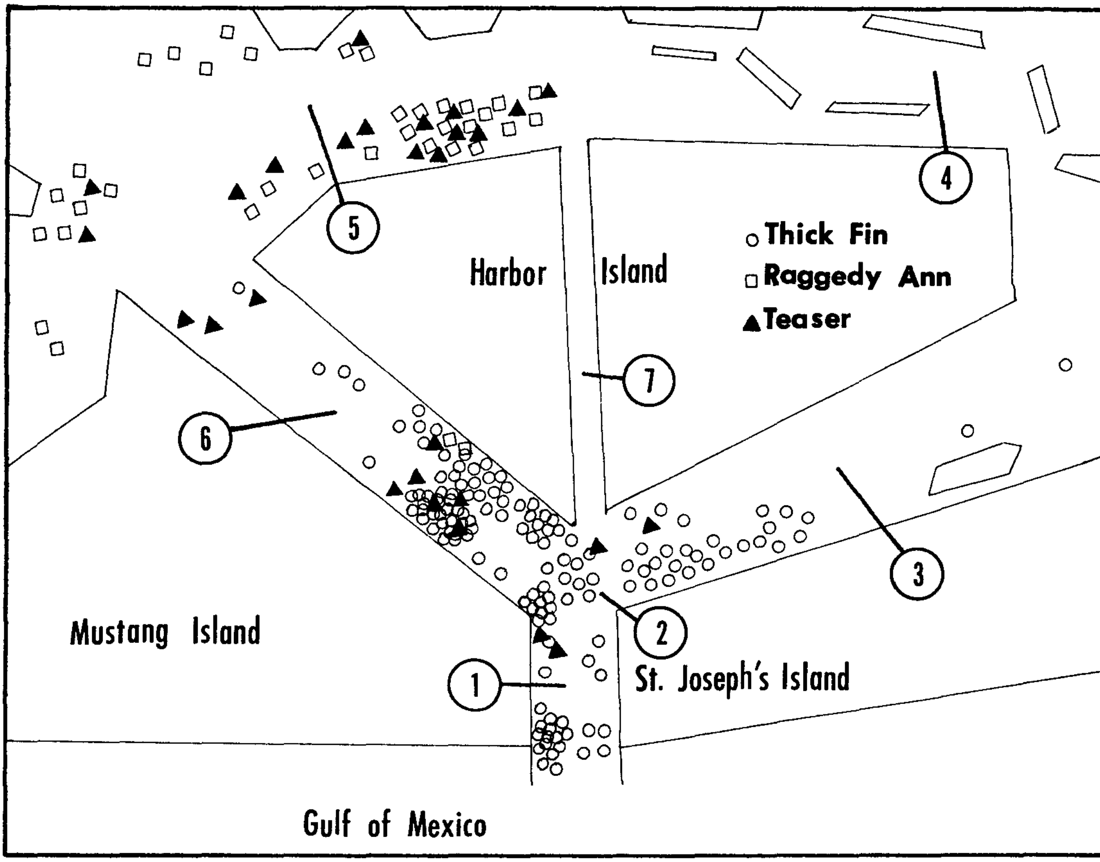

FIGURE 3.—Distribution of sightings of three bottlenose dolphins (Thick Fin, Raggedy Ann, and Teaser) near Port Aransas, Texas, during 1976-77. The map is a diagram (not drawn to scale) of the study area shown in Figure 1, and the circled numbers identify the same seven sections of the study area given in Figure 1.

TABLE 4.—Sightings of individual bottlenose dolphins in inshore waters near Port Aransas, Texas. Only dolphins sighted 25 or more times from June 1976 through May 1977 are included. Region A includes Aransas Pass (1), the Confluence (2), Lydia Ann Channel (3), and Corpus Christi Channel (6) (total area, 11 km²). Region B includes Morris and Cummings Cut (5) (total area, 14 km²).

Individual (total no. sightings)	No. sightings in Region A (%)	No. sightings in Region B (%)	No. sightings outside Regions A and B
Thick Fin (140)	140 (100%)	0	0
Short Triangle (142)	139 (98%)	0	3 (2%)
Snaggle Tooth (28)	26 (93%)	1 (4%)	1 (4%)
Bent Fin (64)	57 (89%)	3 (5%)	4 (6%)
Trigger (25)	20 (80%)	1 (4%)	4 (16%)
Raggedy Ann (36)	2 (6%)	32 (89%)	2 (6%)
Tiki (33)	4 (12%)	29 (88%)	0
Chopper (52)	3 (6%)	47 (90%)	2 (4%)
Teaser (28)	13 (46%)	15 (54%)	0
Cloud (33)	21 (64%)	8 (24%)	4 (12%)

the northeast boundary where Lydia Ann Channel joins Aransas Bay.

DISCUSSION

Seasonal Occurrence

Contrary to Gunter (1942), the present study provides evidence for seasonal variation in abundance of *T. truncatus* in Texas. As Figure 2 shows, the winter population in the study area was about twice the size of the summer population. The population increased or declined during the fall and spring as dolphins moved into or out of the study area. Irvine et al. (footnote 3) noted fewer dolphins in their study area in central west Florida during the winter than during the summer. They also observed seasonal changes in the distribution of bottlenose dolphins in that area. Seasonal migrations have been hypothesized for *T. truncatus* on the Atlantic coast (True 1890), and Caldwell and Caldwell (1972) noted variations in abundance of

T. truncatus in northeastern Florida on a seasonal basis. Würsig (1978) found no evidence for a seasonal migration of *T. truncatus* in Argentina.

The belief that the seasonal variation in abundance of bottlenose dolphins in the study area was an annual occurrence and not a result of the unusually cold winter of 1976-77 was supported by my 1977 fall and winter observations. Later observations on the seasonal presence of Thick Fin and Bent Fin in the study area by Poff (footnote 5) further substantiated the first year's data.

Bottlenose dolphins in the Port Aransas area responded to seasonal changes by emigrating out of the study area for the winter, immigrating into the study area for the winter or by remaining year-round residents. Hogan (footnote 2) and True (1890) reported the first and third patterns for *T. truncatus* in the Atlantic.

The three responses to seasonal changes exhibited by dolphins in the study area prohibit a simple explanation of seasonal occurrence patterns. Two factors cited as affecting cetacean distribution are water temperature (Gaskin 1968) and food availability (Mercer 1975). Water temperature in the study area changed from a winter mean of 11.4° C to a summer mean of 28.4° C, and this change could have had a direct or indirect effect upon dolphin movements. Food is available to dolphins both in the study area and in the Gulf of Mexico during the winter: most fish species emigrate from the bays to the Gulf for the winter, but a few species spend the winter in the bays (Gunter 1945). Three of the latter species—striped mullet, *Mugil cephalus*; sand trout, *Cynoscion arenarius*; and black drum, *Pogonias cromis*—have been found in the stomachs of bottlenose dolphins (Gunter 1942). Other fish species wintering in the bays near Port Aransas were killed by cold spells during the winters of 1940 and 1951 (Gunter 1941; Gunter and Hildebrand 1951). Of these, spot, *Leiostomus xanthurus*; croaker, *Micropogon undulatus*; sheepshead, *Archosargus probatocephalus*; spotted trout, *C. nebulosus*; pinfish, *Lagodon rhomboides*; and ribbonfish, *Trichiurus lepturus*, are eaten by *T. truncatus* (Gunter 1942; Kemp[7]). If water temperature and food availability influence the seasonal occurrence of dolphins in the study area, individual dolphins or social groups may have different temperature or food preferences.

Daily Movements

Dolphins generally move against the tide in the lower sections of the study area, although they moved against the ebb tide more consistently than they moved against the flood tide (Table 2). In all other studies where cetacean movements and tides were correlated, cetaceans moved with tidal currents (Irvine and Wells 1972; Norris et al. 1977; Irvine et al. footnote 3; Würsig[8]). Tide was significantly related to dolphin movements in only one case in the upper section of the study area, and the strength of the relationship there was weak ($V = 0.139$). In two other cases where tide and direction were significantly related in the upper section of the study area, insufficient data made the chi-square results potentially invalid. This lack of tidal effect for the upper bays agrees with the observation that gray whales moved with tidal currents in channels but ignored tidal flow in bays (Norris et al. 1977).

Dolphins consistently moved against the ebb tide in Aransas Pass where the strongest ebb tides were slightly stronger (2.5 km/h) than the strongest flood tides (2.4 km/h) (Smith 1979) and where there was a net outflow averaging 0.3 km/h (Smith 1978). Dolphins showed little or no consistency in their tide-related movements in Morris and Cummings Cut where inflow and outflow should be approximately equal in strength and net effect (Smith 1978). The tidal data indicate that dolphins respond to the dominant tidal currents in this area by moving against them, and that their movements are less affected by tide in areas where tidal effects are diluted such as in the upper bays.

Two explanations for the movement of dolphins against tidal flow seem possible. First, the countercurrent movement may represent a method of feeding. Dolphins may catch fish more easily when the fish are swimming with or being carried by the current. The possible increase in feeding efficiency might outweigh the energy expenditure required to move against a strong current. There is evidence that more fish move through Aransas Pass during ebb tides than during flood tides: "The difference in catch [of fishes in Aransas Pass] between flood tide collections and ebb tide collections was tremendous. Few specimens were collected during flood tide, although the tide trap was low-

[7]Kemp, R. J. 1949. Report on stomach analysis-Delphininae. Annual Report of the Marine Laboratory of the Texas Game, Fish and Oyster Commission for the fiscal year 1948-1949. Unpubl. manuscr., p. 111-112, 126-127.

[8]Würsig, B. 1976. Radio tracking of dusky porpoises (*Lagenorhynchus obscurus*) in the south Atlantic, a preliminary analysis. *In* FAO-ACMRR Scientific Consultation on Marine Mammals, Bergen, Norway, p. 1-21.

ered for almost as many flood tide collections as ebb tide." (Copeland 1965). Thus, dolphins may have developed a special technique for taking advantage of the concentration of food which apparently occurs in Aransas Pass during ebb tide. A second possibility is that dolphins which maintain a stationary position against a strong tidal current, as dolphins were frequently observed to do, were resting. Resting captive dolphins reportedly face against the current in the tank and use slow beats of the fluke to maintain position (McBride and Hebb 1948).

The relationship between time of day and dolphin movements was stronger in Morris and Cummings Cut than in the lower sections of the study area (Table 3). The observation that most dolphins moved northward early, all directions at midday, and southward late in the day was substantiated statistically (Table 3). The higher Cramer's V values for the time of day-direction relationship as compared with the tide-direction relationship indicated that time of day influenced direction of movement more than tide did in Morris and Cummings Cut.

The agreement between individual and group movement data in the present study showed that group size was not a significant variable. In contrast, Irvine et al. (footnote 3) found that more dolphins moved with the tide than against it, because group sizes were larger for dolphins moving with the current. They found approximately the same number of groups moving against the tide as with it.

In summary, dolphin movements were significantly related to tide and time of day in some sections of the study area. The relationship with tide was strongest in Aransas Pass where tidal effects were most pronounced and resulted in a net outflow. The relationship with time was strongest in Morris and Cummings Cut where tidal effects were diluted.

Individual Distribution Patterns

The concentration of sightings of individual dolphins in portions of the study area (Figure 3, Table 4) indicated that some individuals included parts of the study area in their home ranges (as defined by Burt 1943). Caldwell (1955) provided the first evidence for *T. truncatus* having a home range. Later, Caldwell and Caldwell (1972) proposed a dumbbell-shaped home range for *T. truncatus* which included two home ranges connected by a traveling range. At least two interpretations of my data are possible: each dolphin had one home range that extended outside of the study area, and some dolphins used different portions of their home ranges on a seasonal basis; or each dolphin had two or more home ranges connected by traveling ranges, and one home range partially or completely coincided with the study area and was used seasonally. Irvine and Wells (1972) and Saayman et al. (1973) indicated that the bottlenose dolphins which they studied exhibited localized movements, but did not specify home ranges. Wells et al. (in press) defined a home range of 85 km^2 for the dolphin herd which they studied, and they stated that it was inhabited year-round by at least some of the dolphins.

Eight of the 10 dolphins whose distributions were considered in Table 4 apparently recognized a boundary between Regions A and B. The boundary might have been a physical feature (e.g., deep channels versus large, shallow bays), or it might have been a social barrier separating social groups. Two dolphins, Teaser and Cloud, passed over the apparent boundary between Regions A and B on a regular basis. Segregation according to sex in the two regions is unlikely because Short Triangle, Raggedy Ann, and Teaser were females and used Region A, Region B, and Regions A and B, respectively.

Southpaw and Half Fin and the other dolphins with unique dorsal fins that were observed only in the Gulf of Mexico may be part of a population of *T. truncatus* that is socially or otherwise segregated from inshore *T. truncatus*. The existence of offshore *T. truncatus* has been discussed (Mitchell 1975; Odell et al.[9]). However, it is not known whether offshore and inshore *T. truncatus* are reproductively isolated and, if they are, why this is so.

The February 1977 sightings of Short Triangle and the October 1976 sighting of Thick Fin indicated that they may have spent the winter in the Gulf of Mexico or in other bay systems reached by traveling through the gulf. The June and July 1979 sightings of Thick Fin at Port Aransas and Port O'Connor showed that *T. truncatus* does move long distances in fairly short periods of time. Würsig and Würsig (1977) documented a round-trip movement of 600 km for *T. truncatus*, but this

[9]Odell, D. K., D. B. Siniff, and G. H. Waring (editors). 1975. Final report: *Tursiops truncatus* assessment workshop. Rosenstiel School of Marine and Atmospheric Sciences, University of Miami, Miami, Fla., 141 p.

movement occurred over a 15-mo period. The observations of Bent Fin entering and leaving the study area indicated that he may have inhabited the bays north of the study area during the spring and summer.

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