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John K. Reed
Harbor Branch Foundation, Inc.

R. Grant Gilmore
Harbor Branch Foundation, Inc.

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INSHORE OCCURRENCE AND NUPTIAL BEHAVIOR OF THE ROUGHTAIL STINGRAY, *Dasyatis centroura* (DASYATIDAE), ON THE CONTINENTAL SHELF, EAST CENTRAL FLORIDA

The roughtail stingray, *Dasyatis centroura* (Mitchill) 1815, is considered to be a warm temperate species occurring from Cape Cod and Georges Bank south to Key West (Fowler, 1945; Phillips, 1956; Struhsaker, 1969), and along the west coast of Florida to the northern Gulf of Mexico (Springer and Bullis, 1956; Wahlquist, 1966). This species is the largest western Atlantic dasyatid ray. Females may reach 208 cm disc width and 340 kg weight and tend to be larger than males (155.9 cm and 144.3 cm mean disc width, respectively; Struhsaker, 1969).

Struhsaker (1969) published a comprehensive study of *D. centroura* based on extensive trawl records from Cape Cod to Florida. He reported that the winter populations are segregated by size with smallest juveniles found in warm, deeper (37-73 m) waters of the outer shelf off the Carolinas, larger juveniles at intermediate depths (27-64 m) from South Carolina to Georgia, and subadults and adults in still shallower (4-46 m) live-bottom habitats off Georgia and north Florida. Mature females occurred in relatively shallow water (12-20 m depths) more often than mature males, and most males (61.1%) were collected at depths between 29 and 37 m. The adult population breeds during winter and early spring followed by further migration and sexual segregation of the larger females, some of which are gravid, to south of 29° 00'N. With the warming of water in the spring, the populations of the various sizes move inshore into coastal habitats and northward until by midsummer the main population is north of Cape Hatteras with the juveniles inshore and the adults

offshore (Struhsaker, 1969). He further predicted a 9-11 month gestation period with parturition occurring in fall or early winter during the southerly migration.

Recent captures by surf fishermen of large female *Dasyatis centroura* throughout the year at depths less than 7 m and observations from a research submersible of breeding behavior on the outer shelf-edge (80 m), both off central eastern Florida, are reported herein to further clarify the behavior and distribution of *D. centroura*.

At 0935 on November 30, 1978, a male and female roughtail stingray *Dasyatis centroura* were observed for a period of 10 minutes in an apparent courtship or mating ritual. This observation, using the JOHNSON-SEA-LINK research submersible (J-S-LI, Dive Number 615), took place near the base of a deep-water, *Oculina varicosa* coral bank (Reed, 1980) 27 km east of Ft. Pierce, Florida at 27° 32.8'N, 79° 58.8'W and at a depth of 80 m. The area was a flat sand bottom 20-30 m from the base of the 17 m high *Oculina* coral bank. A few pieces of limestone with *Oculina* rubble protruded through the green silty-sand, and patches of the gorgonian *Titanideum frauenfeldii* and the antipatharian *Cirripathes desbonii* covered the bottom. Visibility was 6-8 m, current 5 cm/sec from the south, and the temperature was 20.4°C. An externally mounted Benthos® camera with 200 Ektachrome film and a hand held 35 mm single lens reflex camera were used to record the event. Thirty-five sequential photographs were taken of these rays.

The pair of rays were first sighted swimming 10-20 cm off the bottom. The female was estimated at 150-200 cm disc width with a 50 cm tail which had the end missing. The male was slightly smaller in disc width (approximately 150 cm) with a tail length of 2 m. These are within maturation sizes which Struhsaker (1969) predicted to be 150-160 cm disc width for fe-

males and 145-150 cm for males. Both rays were uniform gray on the pectoral fins, mottled dark and light toward the back and on the tail, and white on the belly.

Initially, the male ray closely followed the female with its snout close to the posterior edge of the female's pectoral fin. The male advanced over the left posterior third of the female's body and followed closely in that position for a short period. Occasionally they stopped and stirred up the sediment with their pectorals, obscuring the view. The female then proceeded to settle to the bottom and remained motionless. Her body was arched in the center with apparently only the outer edges of the fins touching the sand. The pelvic fins were also only touching along the posterior edge which caused the base of the tail to be raised several centimeters off the bottom, thus forming a cavity underneath the ray. The male moved over the posterior lateral quadrant of the motionless female. The male started moving the anterior part of his body against the female's back in an apparent nudging or biting motion. The

female occasionally curved her tail, pushing against the male's pectoral fin, or slowly undulated her pectoral fins but remaining in position with the body arched (Fig. 1). After several minutes the male swam out of sight. The female then swam a short distance and stopped. White scratches were observed on the mid-posterior edge of the female's pectoral fin. These scratches were not evident in photographs taken prior to her contact with the male. The male reappeared, circled the submersible and then returned to the same position over the female. After a short period they swam off together. Copulation was not observed.

Slow swimming with the male on the female's back is similar to observations by Brockmann (1975) of *Dasyatis americana*. Breder and Rosen (1966) noted the biting of the female's pectoral fin in the Rajidae which also may be part of the dasytid mating ritual.

Table 1 presents data on hook and line captures of 17 *Dasyatis centroura* specimens by surf fishermen using shark fish-

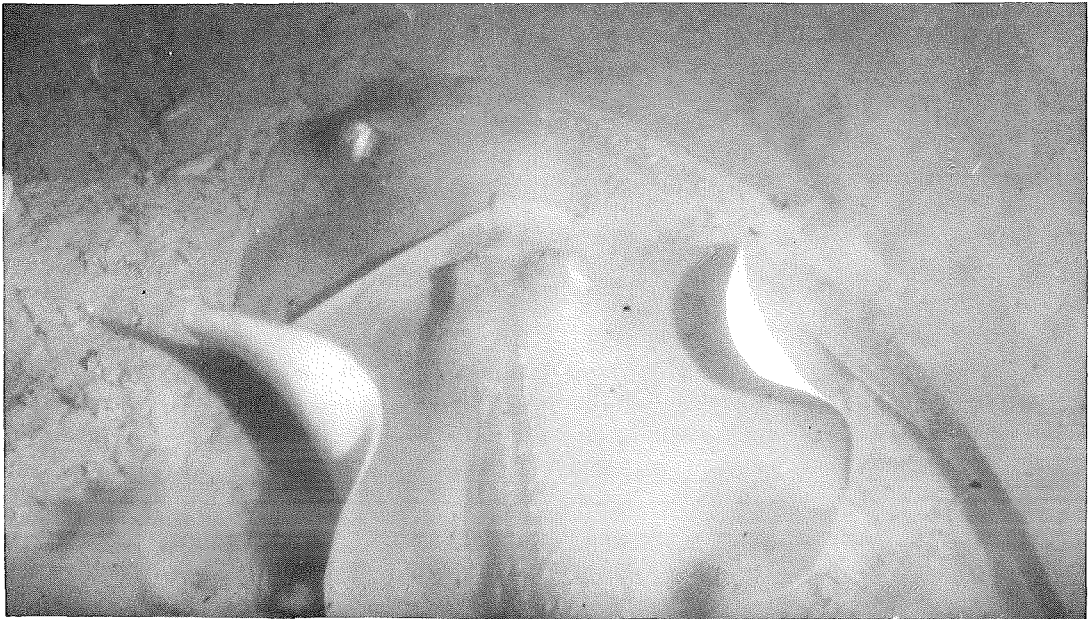


Figure 1. Pair of rough-tail stingrays *Dasyatis centroura* (male, top; female, bottom) observed at a deep-water *Oculina* coral bank near the shelf-slope break off central eastern Florida (27° 32.8' N, 79° 58.8' W; 80 m depth).

ing rigs off Melbourne Beach, Florida (28° 01' N, 80° 02.5' W). All specimens were mature adults over 150 cm. Beach captures reveal a year round occurrence of large, mature females although most (65%) occurred during the colder months December through March. Two specimens containing embryos (212-240 mm disc width) were taken in June and July.

Water temperatures were not taken at the time of inshore captures; however, summer cold upwellings may occur along central and south Florida at various times between April and September. At Melbourne Beach these rays could have experienced water temperatures from 17.0° to 28.0°C, which is near the temperature range of 15.0-25.5°C and optimal range of 15.0-22.0°C given for the species by Struhsaker (1969). Also the rays occurred on the deep *Oculina* reef in November at the time when monthly temperatures are the highest on these shelf-edge reefs, ranging from 21.2-26.7°C with a mean of 24.4°C. Temperatures on these deep reefs, however, are coolest in July and the

yearly range is 7.5-26.7°C. These records support Struhsaker's (1969) inference that temperatures below 15°C are a barrier to dispersal and may delineate seasonal migration patterns.

The beach capture of female *D. centroura* with embryos in June and July is significant in that the predicted fall and early winter parturition period (Struhsaker, 1969) may start earlier in the summer. A gestation period of 9 to 11 months predicted by Struhsaker (1969) would mean breeding and fertilization may take place from September to December based on a June-August parturition time. The apparent nuptial behavior of a pair of *D. centroura* in November falls within the predicted breeding-gestation parturition time span. This indicates that the breeding period for this species may be broader than previously thought. Also there appears to be a more permanent population of *D. centroura* off the Florida coast that does not follow the summer migration to north of Cape Hatteras. While large females may occur in very shallow (6 m

Table 1. *Dasyatis centroura* specimens caught by surf fishermen off Melbourne Beach, Florida (28° 01' N, 80° 02.5' W). Maximum distance from shore was 300 m, maximum depth was 6-7 m. DW = disc width.

	Date	Sex	Disc Width (cm)	Total Length (cm)	Reproductive State
1975	8 Mar.	—	180.0	360.0	unknown
	5 Aug.	♀	167.6	335.3	unknown
	9 Dec.	♀	167.5	332.5	unknown
1976	- Jan. Three large specimens hooked in the surf 30 to 50 m from shore but released alive due to large size.				
	24 Jan.	♀	160.0	353.8	non-gravid
	26 Jan.	—	190.0	352.5	unknown
	21 May	♀	172.0	tail missing	5-6 small yellow eggs ca. 15 mm diameter in uterus
	10 July	♀	182.5	210.0 part of tail missing	2 embryos, 228 mm and 235 mm DW, both ♀
	18 July	—	150.0	345.0	unknown
1977	19 Dec.	—	165.0	tail missing	unknown
	16 Mar.	—	165.0	—	unknown
	17 Mar.	♀	175.3	342.9	non-gravid
	28 June	♀	175.0	382.5	four embryos; 212, 222, 225, 240 mm DW; 2 males, 2 females
	22 Sept.	♀	185.0	335.0 tip of tail missing	non-gravid
	*4 Dec.	♀	208.0	361.0	non-gravid

*weight, 340.5 kg

depths or less) nearshore waters along the central east coast of Florida, breeding adults also occur at the deep (80 m) shelf-edge reefs.

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John K. Reed and R. Grant Gilmore.
Harbor Branch Foundation,
Inc., RR1, Box 196, Fort Pierce,
FL 33450.

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