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The biology of the finetooth shark, *Carcharhinus isodon*

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Synopsis

The finetooth shark inhabits shallow coastal waters of the western Atlantic from North Carolina to Brazil. It is common off the southeastern United States, where it spends the summer off Georgia and the Carolinas and winters off Florida. The species appears in the nursery and mating areas of South Carolina when the surface water temperature rises above 20° C in late April and early May. Both adults and juveniles are common in the shallow coastal waters of South Carolina through the summer, where they feed primarily on menhaden. The finetooth shark leaves the Carolinas in early fall and migrates southward as the surface water temperature decreases below 20° C. Females reach maturity at about 1350 mm TL. Males mature at about 1300 mm TL. The finetooth shark has consecutive, year-long ovarian and gestation cycles, like most carcharhinid sharks. Mating occurs from early May to early June. Freshly mated females bear a large spermozeugma at the base of each uterus. The spermozeugmata are large almond shaped masses of individual spermatozoa embedded in a supporting matrix. Embryos are lecithotrophic during their first fifteen weeks of development. Subsequently, the embryos establish a placental connection to the mother. Implantation occurs when the embryos measure about 130 mm or at about the fifteenth week of gestation. Gravid females carrying young 480–550 mm TL enter the shallow water nurseries off South Carolina in late May. Parturition occurs from late May to mid-June, after a gestation period of about twelve months, plus or minus two weeks. The young measure 480–580 mm TL at birth. Oocytes grow little during the gestation cycle. After parturition, a cohort of oocytes begins to develop, that will be ovulated the following May. Thus, the ovarian cycle lasts about a year, although most of the oocyte growth occurs in the months just prior to ovulation.

Introduction

The finetooth shark, *Carcharhinus isodon* (Valenciennes in Müller & Henle 1839), is one of the least known carcharhinid sharks in the coastal waters of the southeastern United States. This shark is a migratory species that is locally very abundant off South Carolina from May to September, where it inhabits the surf zone and shallow coastal waters usually at depths 2–5 m or less, and feeds on small fishes (Castro 1983). It is also locally abundant in deeper water 5–18 m off Florida during its migrations and during the winter.

Records of finetooth sharks off the United States are few, consisting mainly of juveniles caught in the surf zone. Radcliffe (1916) reported a 508 mm specimen lacking capture data in the Bureau of Fisheries collection at Beaufort, North Carolina, and said that the species was rare. Burton(1940) first reported the species off South Carolina, recording a

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747 mm male caught in the surf at Morris Island. Springer (1950) reported a sample of 20 females taken off Salerno, Florida, in December. Springer (1950) stated that the finetooth shark appeared in relatively large numbers in waters less than 18 m off Salerno, Florida in December and January and that it had not been taken at other months. He also stated that the species was of little interest to commercial fishermen because the adults were too small and the run lasted only a few days usually during the Christmas holidays. Baughman & Springer (1950) recorded a few specimens collected off Galveston and stated that the species was rare off Texas. Dahlberg & Heard (1969) reported catching 29 juveniles 520–940 mm TL and one adult 1440 mm TL off Sapelo Island and Wassaw Sound, Georgia between 15 July and 5 September. Bearden (1965) added three additional records of juveniles from the surf on Sullivans Island and from the Wadmalaw River in South Carolina. Clark & von Schmidt (1965) mentioned a 760 mm female caught in Lemon Bay, Florida. Dodrill (1977) reported the catch of six specimens on hook and line within 40 m from shore off Melbourne Beach, Florida, and stated that the species was found there from November to April. Branstetter & Shipp (1980), summarized the records and reported a gravid female caught in June off Dauphin Island, Alabama.

The finetooth shark is protected by its shallow water habitat and its diet from commercial and recreational fisheries pursued in deeper waters, and it is generally too fast-swimming to be caught by shrimp trawlers that operate in shallow waters. Only neonates and small juveniles are occasionally caught by shrimp trawlers. An occasional specimen is taken on hook and line while fishing in the surf or shallow water 2–4 m deep. It is taken on longlines in deeper water about 20 m depth off Florida, but only during brief periods during the North-South migrations. Thus, the finetooth shark has been encountered infrequently by biologists and its habits are poorly known. However, the species is often and easily caught in gill nets set in shallow bays and river mouths at depths of 2–5 m off South Carolina during the summer. Because of its abundance, the species contributes significantly to the summer gill net catch there. The species is easily recognized by the slender, erect, smooth-edged teeth in both jaws, large gill slits, and its dark bluish gray color that extends evenly along the flanks. The characteristic dark bluish gray color of fresh specimens is sufficient for the trained observer to separate finetooth sharks from other coastal species. In this paper I report on the biology of the finetooth shark based on specimens caught off South Carolina and Florida.

Methods

Finetooth sharks were examined during commercial shark fishing operations off Folly Beach and McClellanville, South Carolina and off Daytona Beach, Florida from 1981 to 1991. South Carolina specimens were generally caught in gill nets while the Florida specimens were caught on longlines. Additional specimens were obtained from shrimp trawl bycatch off Charleston, South Carolina. Sampling operations were conducted in South Carolina from May to October, and in Florida from November to April. A total of 107 females and 90 males were examined. Whenever possible, each specimen was measured, weighed, and examined for reproductive condition and stomach contents. It was not possible to record all the desired data for a few specimens because the examination interfered too much with the butchering work. Total length (TL) was measured on a horizontal line between perpendiculars, from the tip of the nose to the tip of the tail, with the tail at its maximum extension. This method avoids the uncertainty resulting from having the tail at different angles when different observers take the measurement. Total length can be converted to fork length (FL) by using the equation: $FL = 0.84325(TL) - 40$, based on $N = 138$ and $r^2 = 0.98$. Total length can be converted to precaudal length (PCL), from the tip of the nose to the precaudal pit, by the equation: $PCL = 0.773593(TL) - 51$, based on $N = 52$ and $r^2 = 0.99$. Both conversion formulae are based on specimens measured in this study. Sharks were examined in the field. Gonads and pups were brought back to the laboratory whenever possible. Claspers were measured in three ways to facilitate comparison with other works. Clasper length was measured from the point of outside insertion in the pelvic fin to the tip of the clasper (OL); from point of insertion at the cloaca to the tip of the clasper (CL); and in the case of mature claspers, in a folded condition, from the base of the folded joint to the tip of the clasper (FL). The folded measurement can be taken only in mature specimens because immature claspers will not fold. Males were judged to be mature when they had hardened claspers, the head of the clasper or rhipidion opened freely, and the base of the clasper could be rotated, directing the clasper anteriorly (Clark & von Schmidt 1965). Females were considered mature when they were gravid or with eggs larger than 26 mm in diameter, or when the oviducal gland measured more than 20 mm in width and the uteri were developed. Because this shark has consecutive ovarian and gestation cycles, the ovaries of females in their postpartum year may resemble those of developing immature females in having oocytes of similar diameter. Immature females can be distinguished by their oviducal gland, which is smaller than 20 mm in width, and their thin and ribbon-like uteri.

Results

Range and distribution

Compagno (1984) reported that the finetooth shark inhabits the Western Atlantic from North Carolina, and exceptionally New York, to Florida, Cuba, the Gulf of Mexico, and southern Brazil; and that perhaps it also occurs in the Eastern Atlantic off Senegal and Guinea-Bissau. Although Valenciennes in Müller & Henle (1841) gave no locality data for the type specimen, the species has been said to range as far north as New York, based on Dumeril (1865) who said that the type was from the coast of that state (Bigelow & Schroeder 1948). However, the finetooth shark is not mentioned in any faunistic works for areas north of Cape Hatteras (e.g., Nichols & Murphy 1916, Nichols & Breder 1927, Hildebrand & Schroeder 1927, Milstein 1978), or records for those areas are based solely on the type (e.g. Bean 1903). The finetooth was rare in North Carolina, being found only around the Beaufort area; Schwartz (personal communication) also stated that it was not found there every year. Therefore, the presence of the finetooth shark north of Cape Hatteras is doubtful. If it occurs north of Cape Hatteras, it is only as a rare stray.

Records for the Caribbean and the South Atlantic are few. The species is known from Cuba based on Poey (1868), who attributed some loose teeth and a dorsal fin (specimen # 356), that had been sent to him, to *Aprionodon* sp. *dubia.* Later, Poey (1876) assigned those teeth to *'Aprionodon isodon?'* expressing some doubt about the identification. The three teeth depicted by Poey (1868, plate 4, no. 9, 10, 11) have bases that are too narrow, or cusps that are proportionally too long, to belong to a finetooth shark. Poey's specimen (# 356) is in the U.S. National Museum (USNM # 232832). It consists of three teeth about 6 mm each labeled *'Aprionodon* 356'. Poey's depiction of the teeth does not match the present specimens well. One of those teeth has fine serrations on the cusp visible only under a 5-10 × microscope. The other two teeth have shorter smooth edged cusps, and one of these has a strongly oblique cusp. Thus, they can not be the teeth of a finetooth shark. The serrated tooth may belong to a blacktip shark, *C. limbatus,* and the smooth edged teeth are probably lower teeth of a scalloped hammerhead, *Sphyrna lewini.* Guitart Manday (1968) in a faunistic work on Cuban sharks, reports that the species has been recorded from Cuba only once, presumably based on Poey's record. A later faunistic work on Cuban fishes (Guitart 1974) does not include the finetooth shark. Thus, it appears that there are no valid records of the species for Cuba. Applegate et al. (1979) listed the species as occurring in the Gulf of Mexico and possibly in the Caribbean, but without listing any specimens. The species is rare in Trinidad. I did extensive sampling there in 1985–1986 and saw only one specimen, a 1254 mm TL mature male seen in a fish house in Icacos, on 5 Nov 1985, from a catch presumably taken off Moruga. This was the only finetooth shark seen there among hundreds of sharks captured or seen in the market. Sadowsky (1967) illustrated one of two specimens from Cananeia at latitude 25° S, and noted that they were a new record for Brazil.

African records are doubtful. Cadenat (1950) included the species in a list of species reported in Senegal but not observed by him, stating that the species had been seen in the waters around Dakar by Budker, but without offering any records or supporting evidence. Compagno (1984) states that the old African records have not been confirmed, and that it is possible that those records are based on another species, particularly *Carcharhinus brevipinna*. Garrick (1985) summarized reports of finetooth sharks from the eastern Atlantic and also concluded that those records could not be regarded as confirmed.

Migrations

Juveniles appeared in the shallow coastal waters (2–3 m depth) of Bulls Bay, South Carolina in early April in most years and in late March in warm years. The adults appeared in that area in early May. The earliest records that I have for the adults in Bulls Bay are 2 May for non-gravid adult females and adult males, and 21 May for gravid females. The gravid females carrying term pups and having emaciated livers were very abundant in the area during the last week in May. The surface water temperature in the area rises from an average of 18.1° C in late April to 21.6° C in early May, thus the appearance of finetooth sharks seems to coincide with the warming of the waters above 20° C. Both adults and juveniles are abundant at depths of 2–7 m throughout the summer. The species departs South Carolina in September to mid-October as the surface water temperature decreases below 20° C. The latest record I have for a gravid female is for 16 October. The latest record I have for the species off South Carolina is that of a 796 mm TL juvenile caught off Charleston on 26 October.

Based on the catch records of Eric and Norman Sander, two knowledgeable and experienced commercial shark fishermen from Daytona Beach, Florida, finetooth sharks were caught off Daytona Beach at depths of about 20 m from late September to late December, and from early April to early May. Based on their catch records from 1985–1990, the peak of the southward run passes through the Daytona Beach area during the third week in November, and the peak of the spring run occurs during the first week in April. Surface water temperatures ranged 20.1–21.3° C during both migrations. These fishermen caught large numbers of juveniles and adults, at the same locations, at depths of 15–20 m during the migrations. They sporadically caught specimens during the winter, suggesting that the wintering population was not far away, perhaps in waters not fished by them or in South Florida.

Whether the population of finetooth sharks off the east coast is separated from the Gulf of Mexico population is not known. Movements of east coast finetooth sharks into the Gulf have not been demonstrated, and the movements of the Gulf of Mexico population have not been described. During the mild weather of February 1991, unusually large schools of finetooth sharks were encountered by commercial fishermen in shallow waters off the mouth of the Mississippi River in the Gulf of Mexico where the surface water temperature was 20° C (Sonya Girard personal communication).

Reproduction

Mating and fertilization

Two recently inseminated females were caught off Bulls Bay, South Carolina, on 2 and 4 May 1990. Both of these females had a large spermozeugma (Phillipi 1908) at the caudal end of each uterus (Fig. 1). The spermozeugmata were pale yellowish, almond shaped, masses of gelatinous or coagulated material measuring about 35 × 20 × 65 mm (Fig. 2). Microscopic examination revealed that the spermozeugmata consisted of very large numbers of individual spermatozoa embedded in a matrix and distributed throughout the entire structure. The detailed structure of the spermozeugma will be described in a subsequent paper. The recently inseminated females bore mating bites and had oocytes 30 mm in diameter. Another female caught on 7 May 1990 at the same locality had a copious amount of sperm covering the uterine lining and ripe oocytes 30 mm in diameter. A pair of sharks presumed to be a mating couple was examined on 1 June 1983 off Folly Beach. These fishes were caught together in a gill net set reportedly at 15 m at the mouth of the Folly River in South Carolina. The female bore very fresh mating bites and oocytes 30 mm in diameter. A spermozeugma was found midway in each uterus. These spermozeugmata were smaller than those found in the females mentioned above and were found much higher in the uterus. Based on the freshness of the mating bites, and the presence of spermozeugma in the uteri, it is evident that the mating season extends from early May to early June.

Analysis of catches off South Carolina revealed that in late May and early June the adult female stock consisted of approximately equal numbers of gravid females carrying term pups about 460–580 mm TL, and of non-gravid females carrying ripe oocytes about 30 mm in diameter.

Ovarian cycle

Post-partum and non-gravid females possessed 5–8 mm developing oocytes and undeveloped oocytes 1 mm in diameter in early July. Post-partum females examined in early July bore distinct placental marks or 'scars' in their uteri. Placental scars occur in the rear of the uterus and appear as dark red areas, due to their vascularization. At mating time in early May to early June, ovulating females carried 9–11 oocytes 28–30 mm in diameter. Based on the small brood size (2–6 young), and the resorbing eggs found in the ovaries of gravid females, it is evident that not all ripe oocytes are ovulated. At the time of ovulation or fertilization, the shell gland increases in diameter from its usual resting size of 25–28 mm to 34–40 mm.

Gravid females examined in early August had several successive cohorts of developing oocytes in the ovaries. The largest cohort consisted of 6–8 developing oocytes 4–5 mm in diameter. A second cohort consisted of very numerous 2 mm oocytes. A third cohort consisted of a very large number of small, undeveloped oocytes 1 mm or less in diameter. These gravid females also had flattened, flaccid, resorbing eggs 30 × 15 mm in their ovaries. In mid-November, the largest oocytes in midterm females measured 5–9 mm. In May, at term, the largest oocytes of gravid females measured 5–7 mm in diameter, with one exceptional female having oocytes 7–10 mm.

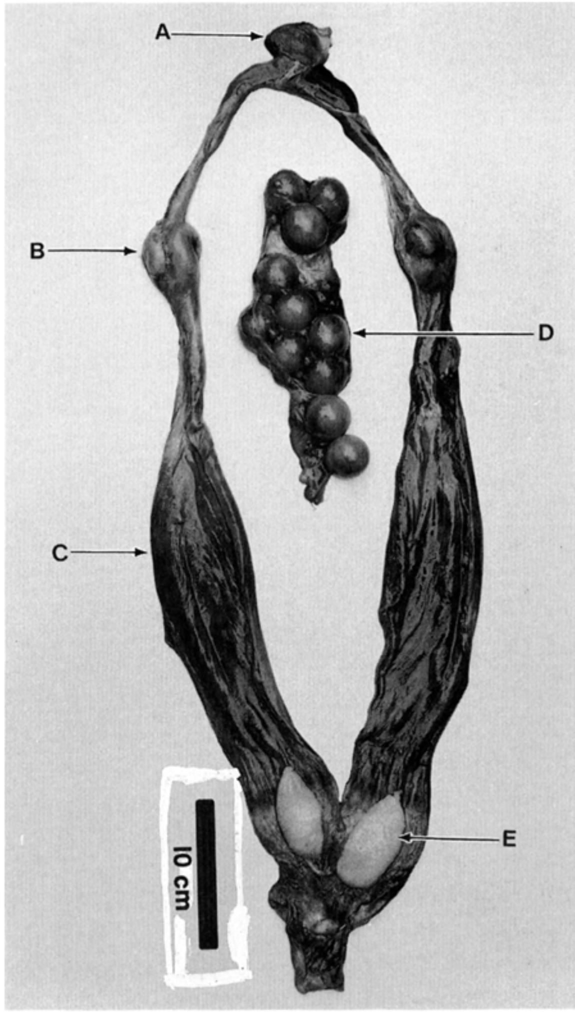

Fig. 1. Reproductive tract of a recently inseminated female, showing the ostium (A), the oviducal gland (B), the right uterus (C) which has been dissected open, the ovary (D) containing eleven visible ripe oocytes about to be ovulated, and a spermozeugma (E) at the caudal end of the uterus. The epigonal organ has been removed and the ovary has been left in the relative position.

Gestation

The gestation period lasts about a year, based on the observation that fertilization occurs in early May and early June, and that females are carrying

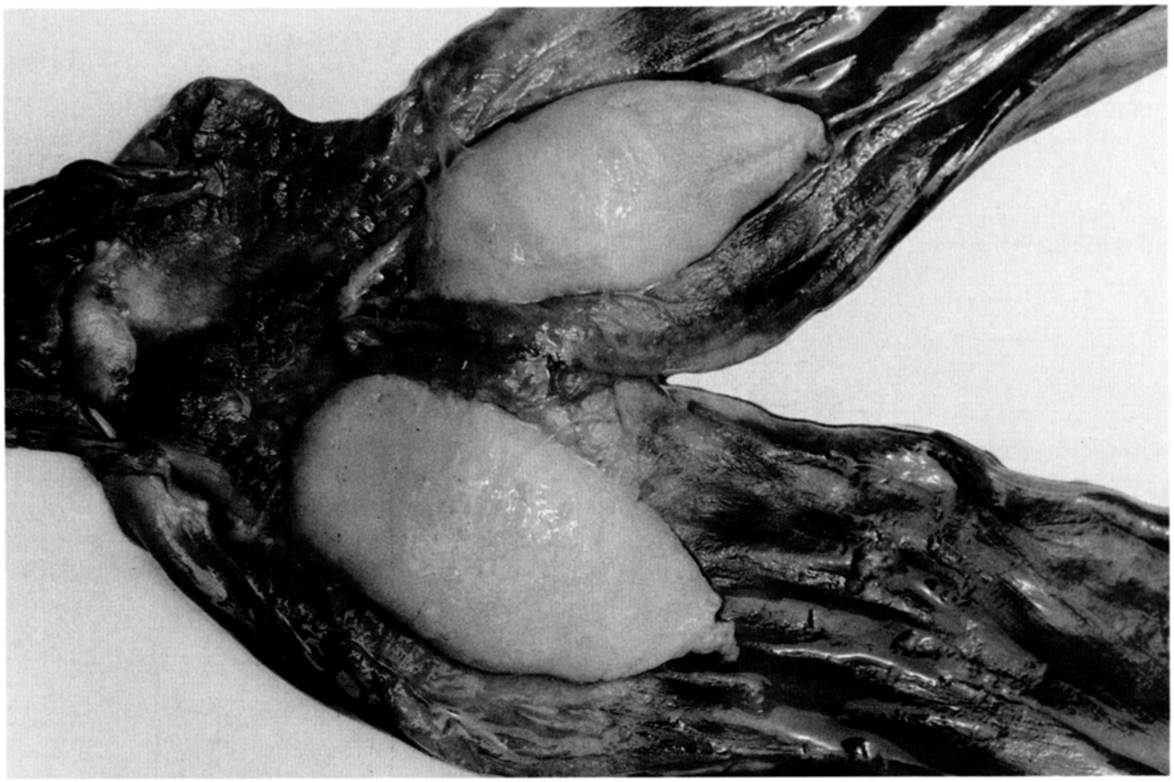

Fig. 2. Detailed view of two spermozeugmata in situ.

term embryos 460–561 mm TL in the last week of May and the first two weeks in June. Analysis of the size of embryos observed through the year (Fig. 3), from the middle of the fertilization period to the middle of the parturition period, yields an average gestation period of exactly one year.

Term females were found from late May to 16 June. After that date only post-partum and newly inseminated adult females were found. Based on the appearance of post-partum females in gill net catches, and of new born young in shrimp trawl bycatch, it appears that parturition occurs in shallow coastal and estuarine waters of the Carolinas from the last days of May to mid-June.

Development

The finetooth shark is a placental species. Embryos 97–107 mm TL observed on 31 July had an enlarged, slightly vascularized yolksac but had not implanted. The yolksacs of embryos 160 mm TL observed on 7 August were found to be well implanted. The umbilical cord is smooth and unadorned throughout development, as in most carcharhinid sharks. Embryos 398–410 mm observed on 18 November had well developed definitive features but their pigmentation was incomplete. Their grey dorsal pigmentation extends only midway on the flanks (Fig. 4), with a narrow band of the darker color extending downward into the lighter colored flanks. In the term embryo, the dorsal grey pigmentation extends evenly to the ventral side (Fig. 5).

Size at birth

The average embryo size in females after 28 May was 524 mm TL. The largest term embryos measured 580 mm TL and weighed 1.14 kg. The smallest free swimming specimen seen was a 551 mm TL specimen caught 21 June 1990. This shark had a nearly healed umbilicus in which only 1 mm remained open. A specimen 584 mm TL caught 8 June 1990 had an open umbilicus 6 mm long, while

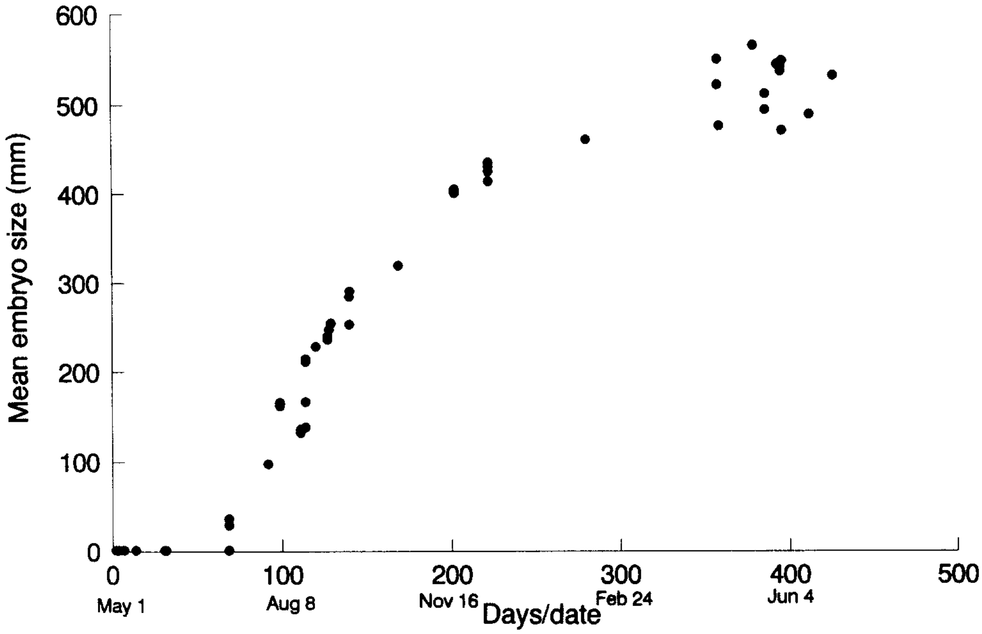

Fig. 3. Mean size of embryos in each brood throughout the year.

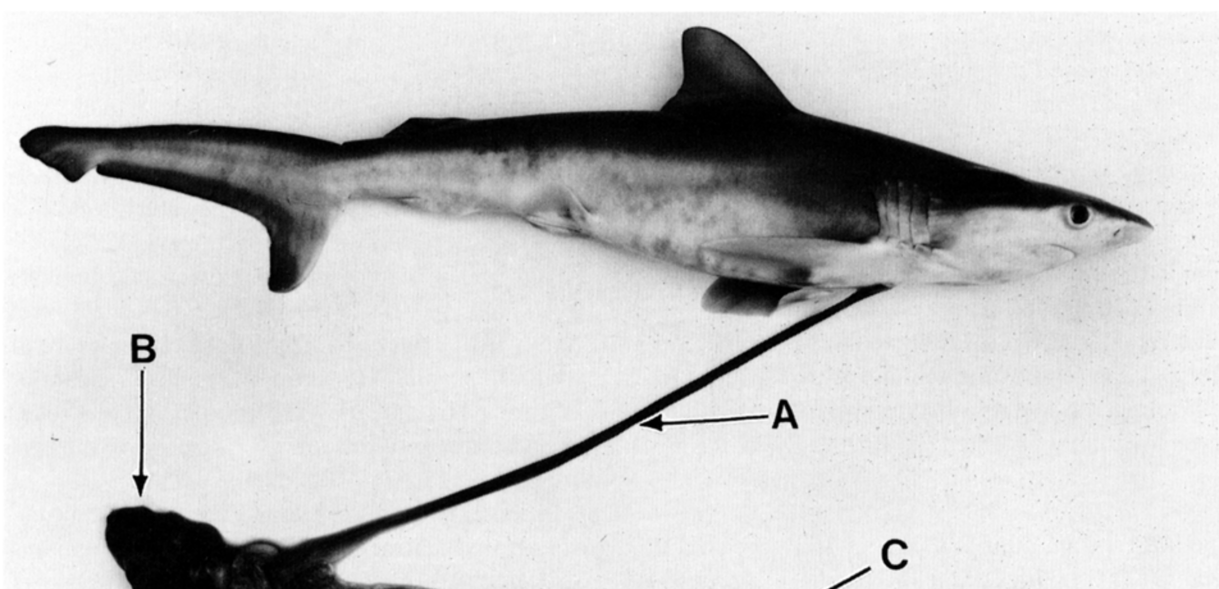

Fig. 4. Mid-term (18 November) embryo 400 mm TL showing umbilical cord (A), the yolksac placenta (B), and the remains of the egg envelope (C). The dorsal pigmentation extends downward in a narrow band.

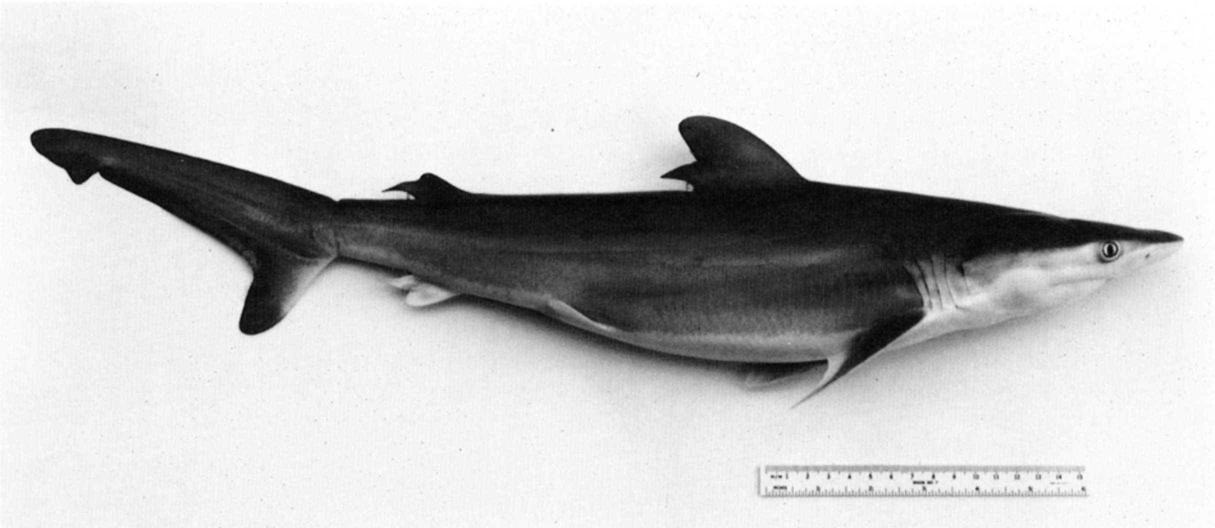

Fig. 5. A near term (May 30) embryo 510 mm TL. The dorsal pigmentation extends evenly to the ventral side.

another caught 15 June 1990 had a nearly healed umbilicus in which only 1 mm remained to close. A 570 mm TL specimen caught 21 June had a healed umbilical scar. All other neonates seen at later dates had healed umbilical scars, suggesting that the umbilicus heals within three to four weeks of birth.

Brood size

Females carried broods of two to six embryos. In a sample of twenty-nine gravid females, the average number of embryos per female was four (Table 1). Term females sometimes aborted their young upon capture. These aborting females were not used in computing the average brood size. Aborted embryos invariably emerged tail first.

Size at maturity

The largest immature female that I saw measured 1335 mm TL in June, and the smallest gravid female measured 1360 mm TL also in June. The immature female had an oviducal gland 17 mm in width, uteri about 20 mm wide, and oocytes 6 mm in diameter. The gravid female carried term pups, indicating that it had matured and had been inseminated the previous spring. The oviducal gland and the uteri are also indicators of maturity. In juvenile females the oviducal gland is smaller than 20 mm in width and the uteri are thin and ribbon-like, measuring 2–6 mm in width. The oviducal gland grows little until females reach 1240 mm TL (Fig. 6). At that time, the oviducal gland grows quickly to a width greater than 20 mm. All females over 1250 mm TL had oviducal glands wider than 20 mm. All adult females, both gravid and non-gravid (resting) females, had oviducal glands measuring 20–29 mm in width. The uteri follow a growth pattern similar to that of the oviducal gland. Based on the size of the smallest gravid females seen, and on the development of the oviducal gland, I concluded that females start to mature at about 1250 mm TL and are mature at about 1350 mm TL, and that the process is completed over the winter or the early spring prior to the first pregnancy.

Immature testes appear as a darker band of tissue on the ventral surface of the epigonal organ. The testes develop gradually (Fig. 7) and first begin to produce sperm at about 1280 mm TL. As the testes mature and become active, they grow outward and away from the epigonal organ. The claspers begin to elongate abruptly at about 1160 mm TL (Fig. 8). Three specimens 1290–1294 mm TL examined in early June had developed claspers longer than 155 mm that were still soft and uncalcified, which rotated poorly and whose heads did not open easily. These males only had a small amount of sperm in the epididymis. The smallest mature male measured 1330 mm. All males seen over 1330 mm TL had calcified claspers longer than 155 mm (measured from the anterior edge of the cloaca to the tip of the clasper), and copious amounts of sperm present in the epididymis. Males seen after the last week in July had inactive, regressed testes that resembled the immature condition.

Maximum size and weight

The largest female seen was a gravid specimen (with four term young) measuring 1596 mm TL and weighing 28.9 kg. The largest male seen measured 1442 mm TL. The length-weight relationship for the species is shown in Fig. 9.

Diet

The stomach contents of a sample of 80 specimens

Table 1. Ovulatory, fertilized, and gravid females. TL = total length of female in mm, G/N = gravid/nongravid, Egg diam. = oocyte diameter in mm, OG = diameter of oviducal gland in mm, # young = total number of young, Young size = total length in mm, Sperm = embryos not visible, only sperm in uterus, N.R. = not recorded, + = total number of young unknown due to possible abortions.

Date	TL mm	G/N	Egg diam.	OG	# young	Young size	Size mean
31. 5.1984	1610	N	30				0
2. 5.1990	1435	N	30	37			0
1. 6.1983	1585	N	30	40		Sperm	0
14. 5.1991	1420	N	26	40		Sperm	0
2. 5.1990	1615	N	30	35		Sperm	0
4. 5.1990	1552	N	30	35		Sperm	0
7. 5.1990	1488	N	30			Sperm	0
8. 7.1987	1374	G	3	28	4	27–30	29
8. 7.1987	1370	G	8	28	4	32–38	36
31. 7.1991	1374	G	5	26	4	91–107	97
19. 8.1986	1430	G			4	128–139	132
19. 8.1986	1370	G			4	132–140	136
7. 8.1984	1520	G	5		4	155–166	161
7. 8.1984	1530	G	5		3	161–168	164
7. 8.1984	1555	G	2		2	164–165	165
4. 9.1982	N.R.	G			5	223–242	236
4. 9.1982	1405	G			4	232–248	240
5. 9.1984	1600	G	5		4	242–257	247
16.10.1990	N.R.	G			4	303–329	319
18.11.1990	1510	G	9	27	4	398–402	400
18.11.1990	1530	G	9	28	4	395–410	403
18.11.1990	1560	G	8	26	6	398–408	404
4. 2.1991	1450	G	13	27	4	354–369	460
31. 5.1984	1548	G	4		5	460–482	470
24. 5.1987	N.R.	G	5	27	4	456–495	475
16. 6.1987	1360	G	7	21	3 +	483–490	488
21. 5.1990	1400	G	7	25	1 +	493	493
21. 5.1990	1467	G	7	28	3	502–520	511
24. 4.1991	1487	G	6	29	4	513–527	521
30. 5.1984	1560	G			4	527–546	536
30. 5.1984	1550	G			4	535–553	541
28. 5.1987	1400	G			4	530–552	543
30. 5.1984	1525	G		26	4	535–549	544
31. 5.1984	1590	G	3		4	542–553	547
23. 5.1990	1555	G	4	25	6	432–561	549
14. 5.1991	1596	G	8	26	4	538–580	564

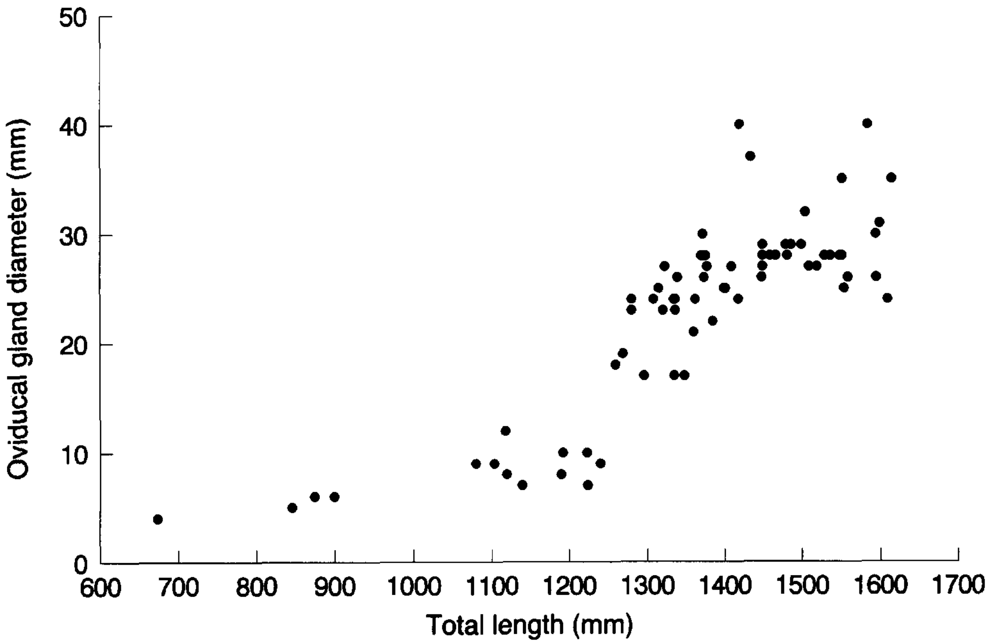

Fig. 6. Development of the oviducal gland versus total length.

were analyzed for prey items. Of these, 39% had empty stomachs, 38% had menhaden, *Brevortia tyrannus,* 14% had unidentifiable small bony fish remains, 3% had juvenile spot *Leiostomus xanthurus,* 3% had shrimp *Penneaus* spp., 1% had Spanish mackerel *Scomberomerus maculatus,* mullet *Mugil* sp. or juvenile Atlantic sharpnose shark, *Rhizoprionodon terraenovae.* In most cases, the

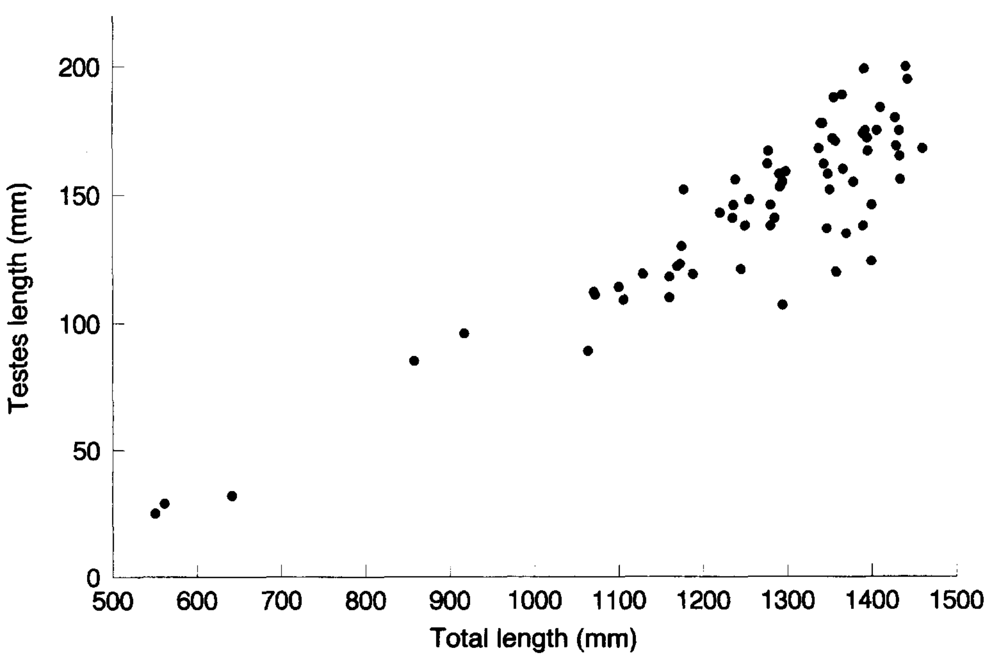

Fig. 7. Development of the testes versus total length.

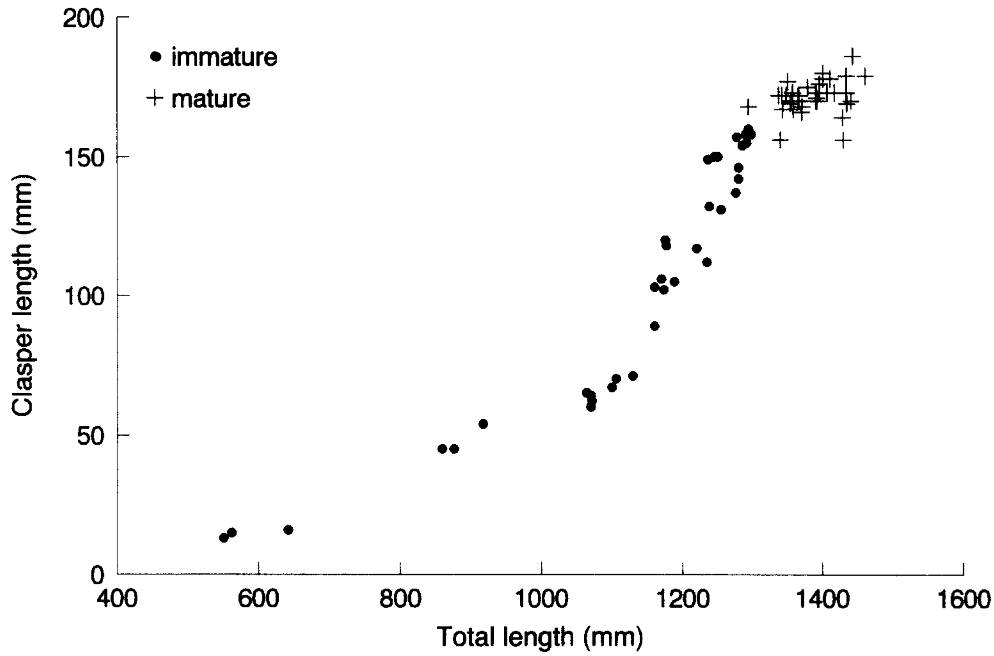

Fig. 8. Development of the claspers versus total length.

menhaden were headless, the rest of the body having been swallowed whole. Most prey fishes examined were small, usually 100–200 mm SL. A single 400 mm TL Atlantic sharpnose shark was the larg-

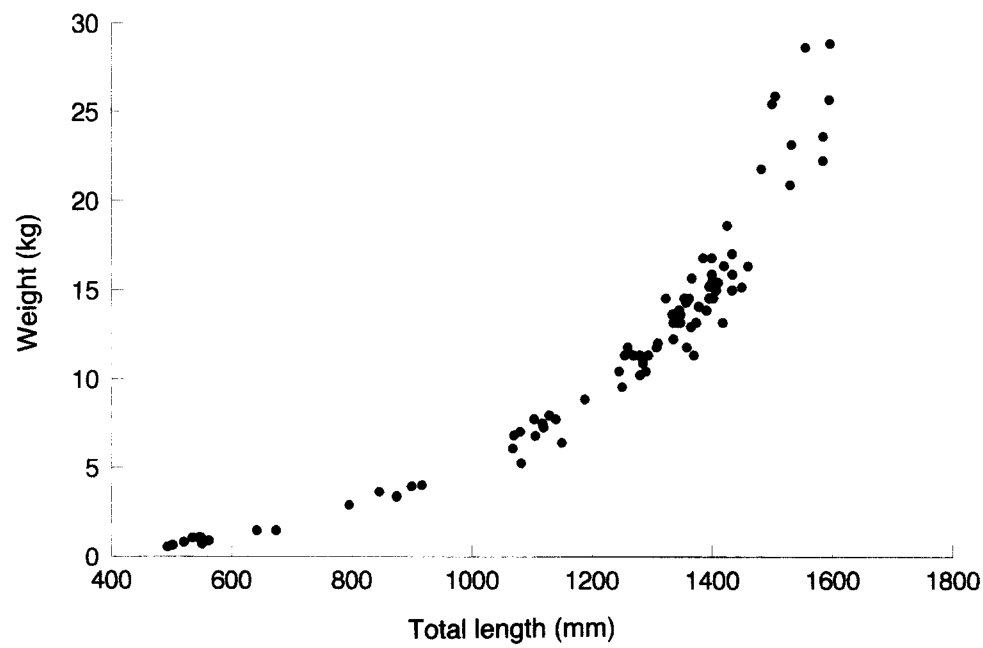

Fig. 9. Length-weight relationship. The line is represented by the equation: $W = (4.0834 \times 10^9)\ L^{3.03406}$, where W = weight, L = length, and $R^2 = 0.98$, and n = 94.

est prey item found in the stomach. This shark was found in the stomach of a specimen that also had a Spanish mackerel and three spots. This variety of prey, i.e., shark and scombroid, and the fact that the prey items were intact in the stomach, were most unusual. Because this shark was caught during the shrimp season, it is possible that the prey items were obtained dead from the shrimp trawl bycatch that is usually discarded at sea in that area.

Conclusions

The finetooth shark inhabits shallow coastal waters of the western Atlantic from North Carolina to Brazil. It is common off the southeastern United States, where it spends the summer off Georgia and the Carolinas and winters off Florida or southward. The finetooth shark appears in the nursery and mating areas of South Carolina when the surface water temperature rises above 20° C in late April and early May. Both adults and juveniles are common in the shallow coastal waters of South Carolina through the summer, where they feed primarily on menhaden and other small fishes. The finetooth shark leaves the Carolinas in early fall and migrates southward as the surface water temperature decreases below 20° C. Migrating schools pass Daytona Beach, Florida, during the third week of November when the surface water temperature is about 20–21° C. By late December and January the schools have been reported off Salerno, Florida (Springer 1950). Where the schools go after they pass south of Salerno is not known. Sporadic winter catches off Daytona Beach, the report by Dodrill (1977) that the finetooth is found off Melbourne Beach from November to April, and reports by fishermen of the species off Ft. Pierce in February, indicate that the wintering grounds extend from central to, at least, south Florida. Schools migrating north pass Daytona Beach during the first week in April, on their way to Georgia and South Carolina. At this time, it is not known whether the population of finetooth sharks off the East Coast is distinct or separate from the population in the Gulf of Mexico. One can only speculate whether or not schools of finetooth sharks from the East Coast and those of the Gulf of Mexico mix together in their wintering areas.

Females reach maturity at about 1350 mm TL. Females smaller than 1250 mm TL have very thin, ribbon-like uteri about 2–3 mm in width, oviducal glands less than 10 mm in width, and ovarian eggs 2 mm or less. In females of about 1250 mm TL, the onset of female maturity begins in early summer. At this time the uteri, the oviducal gland, and the oocytes begin to enlarge. By early June females of 1280–1335 mm TL have uteri and oviducal glands that reach a width of 24 mm, and their oocytes measure 6–8 mm. The process of female maturation is not completed until the following summer by which time the oocytes have reached 30 mm in diameter and ovulation occurs.

Males mature at about 1300 mm TL. The largest juvenile male seen measured 1298 mm TL. Males in a transitional stage, i.e., with large testes 156–162 mm and large but uncalcified claspers are found from early June in the summer range and nursery area. It is likely that these males mature during the summer, but having missed the mating season, they are not likely to mate until the following summer. The testes atrophy after the mating season (by the last week in July) and do not become active until the following spring.

The finetooth shark has consecutive, year-long ovarian and gestation cycles, like most carcharhinid sharks. Thus, in early May, the stock of adult females consists of approximately equal numbers of non-gravid, mating females and of gravid females about to give birth. The stock of the non-gravid, mating females consists of females that have just attained maturity and are mating and ovulating for the first time, and of females that gave birth the previous May. These females have 9–11 oocytes about 30 mm in diameter in late May. Mating occurs from early May to early June. Recently mated females bear a large spermozeugma at the base of each uterus. The spermozeugmata are large almond shaped masses of individual spermatozoa embedded in a supporting matrix. After a short period of time, these structures dissolve and release the sperm. Because of its ephemeral nature, it appears that this structure has not been reported previously. Most authors have reported on shark spermatophores obtained from the epididymis. Matthews (1950) described the spermatophores of the lamnoid *Cetorhinus,* Pratt (1979) described those of *Prionace,* and I have seen those released by *Odontaspis* caught during the mating season in May.

The relationship, if any, of the spermatophores seen in the males of different genera to the spermozeugma seen in finetooth females needs to be clarified. Spermatophores consist of a cortex surrounding a central aggregation of packed sperm, and are small (amorphous and 10–30 mm in *Cetorhinus,* ovoid and oblong and 8–12 mm in *Odontaspis*), and are found in the epididymis in copious amounts. Spermozeugmata are larger structures up to 65 mm in length, and lack the cortex and the organization of spermatophores. They consist of individual spermatozoa embedded in a gelatinous matrix and distributed throughout the entire structure. This is the structure that is deposited by the finetooth male into the female, a single spermozaugma being found in each uterus. It is likely that the spermozeugma is simply a fusion of the spermatophores at the time of mating and insemination, that brings about the dissociation of sperm packets and the activation of sperm.

Embryos are lecithotrophic during their first fifteen weeks of development. Afterwards, the embryos attach to the mother through a placental connection. Implantation occurs when the embryos measure about 130 mm or at about the fifteenth week of gestation. Gravid females carrying young 480–550 mm TL enter the shallow water nurseries off South Carolina in late May. Parturition occurs from late May to mid-June, after a gestation period of about twelve months, plus or minus two weeks. The young measure 480–580 mm TL at birth. Oocytes grow little during the gestation period. After parturition, the next batch of oocytes begins to develop. They will be ovulated the following May. Thus, the ovarian cycle lasts about a year, although most of the oocyte growth occurs in the months just prior to ovulation.

Mid-term young are externally well formed but only partly pigmented along their flanks. Their outward appearance misled Springer (1950) into stating that the finetooth shark gave birth to young 430–480 mm TL during December and January in Florida. Embryos grow more slowly in length during the second half of gestation, but gain significantly in girth and pigmentation. Term young are colored just like the adults, their dorsal pigmentation extending over the flanks to the ventral area.

The consecutive ovarian and gestation cycles reflect the need for placental sharks to store nutrients in the liver for a prolonged period prior to gestation, to be able to produce large eggs. The year long gestation period and the emaciated livers of term females reflect the heavy nutritional demands of relatively large embryos.

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