

Preliminary Report on the Former Net Fisheries for *Tursiops truncatus* in the Western North Atlantic¹

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The net fishery for *Tursiops truncatus*, the bottlenose dolphin, is relatively well documented at Cape Hatteras, less so at Cape May. The Cape Hatteras fishery peaked in 1885-90, with catches of 2000 and more per annum. Catches were largest during fall and spring months; few porpoises remained, or were caught, in the area in summer. School size was up to 600, with a nearly equal sex composition but a wide size range in spring. Possibly there was more segregation in fall. Fetal lengths reported might indicate two breeding peaks. The present status of the population is not known.

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La pêcherie au filet de *Tursiops truncatus* est relativement bien documentée au cap Hatteras, moins bien au cap May. La pêche du cap Hatteras atteignit un sommet en 1885-90, avec prises annuelles de 2000 et plus. Les prises étaient à leur maximum pendant les mois d'automne et de printemps; très peu de dauphins séjournèrent ou étaient capturés dans la région en été. Les bancs pouvaient comprendre jusqu'à 600 individus, avec proportion des sexes à peu près identique, mais gamme étendue de taille, au printemps. Il est possible qu'il y ait eu plus grande ségrégation en automne. Les longueurs signalées pour les foetus peuvent indiquer deux pics de reproduction. On ignore le statut actuel de la population.

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SEVERAL small whale fisheries have operated along the Atlantic coast of the United States. The most consistent and economically important of these was the Cape Cod pilot whale fishery. This fishery was in existence in the mid-1700s and continued into the early 1900s, with an apparent peak in the 1870s and 1880s, when catches of up to 2000-3000 *Globicephala melaena* per year were recorded (Clarke 1887a). There are also indications that harbour porpoises (*Phocoena phocoena*) and Atlantic white-sided dolphins (*Lagenorhynchus acutus*) were occasionally taken in this area (Clarke 1887a; U.S. National Museum files), and Ward (1880) described a porpoise fishery in Maine that may have been based on a combination of these species.

Stearns (1887) briefly described a small harpoon fishery for what was probably the bottle-

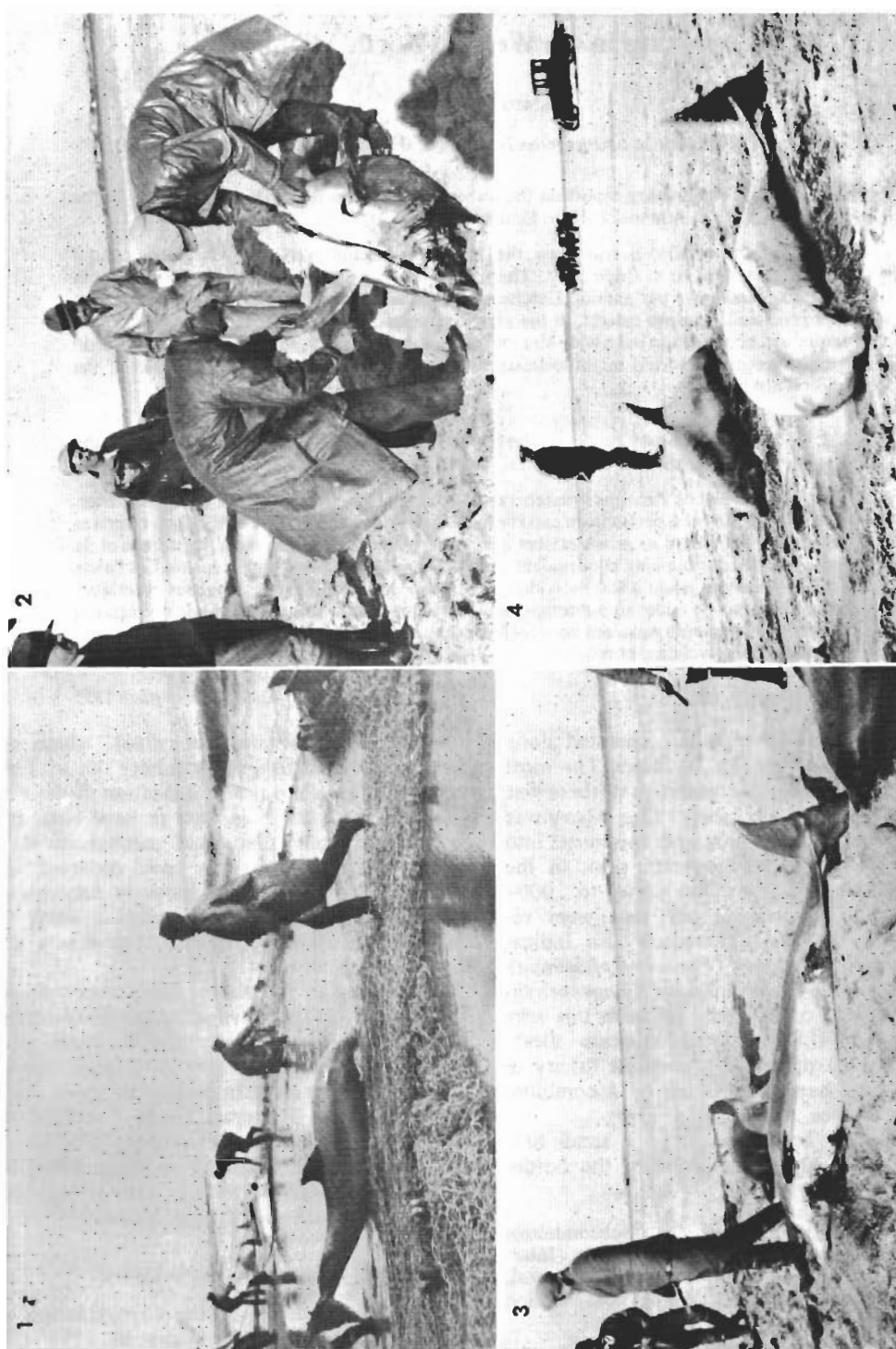
nose dolphin (*Tursiops truncatus*), which operated coincidental to a shark fishery out of Tampa Bay, Fla. There is no clear indication of the extent of this fishery, but it appears to have been small. It is quite likely that local catches of several species of small cetaceans have occurred along with a variety of net and harpoon fisheries. For example, Clark (1887b) recorded a small incidental catch of porpoises in a trap fishery along the Rhode Island coast.

In addition to the above, there were two well-documented net fisheries for the bottlenose dolphin along the Atlantic coast, and a third, poorly known net fishery that may have been based on this species. The most important of these was the fishery at Cape Hatteras, North Carolina (Fig. 1-4; True 1885b, d, e; Townsend 1914a, b). The others were a small fishery at Cape May, New Jersey (True 1884, 1885a), and a very early fishery on the east end of Long Island.

History of Exploitation

The porpoise fishery in the Cape Hatteras area was recorded as having begun in 1797 (Stick 1958), and operated at a moderate level (catches of 400-500 porpoises per year) until 1860 when

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FIGURES 1-4. Fishery for *Tursiops truncatus* at Cape Hatteras, North Carolina.

FIG. 1. Removing a catch of porpoise from a seine, February 10, 1928; FIG. 2. Skinning a porpoise on the beach, February 10, 1928. The melon has been removed, and from the manner of the cuts, the skin is being taken for leather; FIG. 3-4. Porpoises from a catch on February 10, 1928.

it was discontinued, possibly due to the impending Civil War (Clark 1887a; Earll 1887; Stevenson 1904a). The fishery was revived, probably in the season of 1883–84, by Messrs Cooke and Sparks of Philadelphia, and reached its peak in the years 1885–90, closing again in 1893 (Stevenson 1904a, b). From this date, the record of the fishery is less clear. Stevenson (1904b) indicated that as of 1902, the fishery had remained inactive. Townsend (1914b) gave catch figures for the years 1907–14, and indicated that the fishery was then being operated by the William F. Nye Co., of New Bedford, Mass. The Report of the U.S. Fish Commission for 1918 listed 1050 lb of "other aquatic hides" (non-shark) for North Carolina, which may have come from a porpoise fishery. Kellogg (1940) indicated that fishery closed in 1929.

The geographic extent of the Hatteras fishery during various phases of its operation is not clear. Stick (1958) indicated that the fishery began at Ocracoke Inlet in 1797. The bulk of the fishery appears to have operated in the immediate area of Cape Hatteras during the 1880s, and later from 1907–29. He also, however, indicated that porpoise fishing was pursued in the Cape Lookout area, where shore whaling was more active. The United States National Museum contains a large collection of skulls of *Tursiops truncatus* obtained from the Cape Lookout area (Ft. Macon) in December of 1871. The condition of many of these skulls indicates that they were taken from fresh animals, suggesting that a fishery was then in operation. This serves to complicate the catch statistics, since some of them clearly refer to the Cape Hatteras area alone, while others may include the whole of the Outer Banks. For purposes of this paper, the Hatteras fishery is meant to include all of the Outer Banks area, which probably only involved a single migratory porpoise population.

The porpoise fishery in this area was a logical extension of the shore seine fisheries for food fish, which provided the background in fishing technique, and the shore-based whale fishery which provided the background for utilization of marine mammal products.

Fishing Season, Migration

True (1891) stated that porpoise schools were found moving south in the fall, then turning north in the spring, with a few remaining in the area during the summer, although there were apparently not enough to support a summer fishery. Much of this migration was within a hundred

TABLE 1. Catches of bottlenose dolphin, *Tursiops truncatus*, by month at Cape Hatteras.

	1884–85 Season (True 1891)	1885–86 Season (Stick 1958)
Nov.	246	
Dec.	89	171 ^a
Jan.	36	165
Feb.	111	210
Mar.	219	205
Apr.	264	282
May	303	262
Total	1268	1295

^aCombined catch for November 21 to end of December.

yards of the shore, providing the opportunity for a shore-based net fishery.

Table 1 gives catch figures by month for the two seasons for which data are available. The data given by Stick (1958) for the 1885–86 season represent the catch of one of the two crews operating. The other crew took 754 porpoise for the same 6-mo period. The catch of 171 in 1885–86 represents the catch from November 21 through the end of December.

In general, the larger catches seem to have been at the beginning and end of the season, the record catch apparently being 618 for the first 2 wk of November 1886. This was taken by one of the three crews operating that season in the Cape Hatteras area (Stick 1958). The highest catch days given by Stick (1958) were also near the ends of the seasons, being 142 on April 23, 1886, and 170 on November 1, 1886. The lower catches during the middle of the season may be due to the greater portion of the population having passed to the south of the area, or, more likely, to inclement winter weather.

The stalked barnacle, *Xenobalanus* cf. *X. globicipitis*, was seen on the trailing edges of the appendages of northward migrating animals in late April and May, but was not present on south-bound animals in autumn or winter (True 1891). Animals with these organisms attached were referred to as "Tassel-fins."

Fishing Methods

True (1885e) provided the best description of the technique used during the peak of the fishery. Four to six nets of 18-inch mesh, 100–200 yd long, were carried in as many boats. When a school of porpoise was sighted along the shore, two or more boats set a line of nets outside of

the school, parallel to the shore. When the school had moved between this net line and the shore, nets were set first in front of, then behind the school, enclosing it. The ends of these nets were joined and left in place while the porpoise were swept out and beached using one or more small seines of finer mesh. Clark (1887a) said the outer net was of 11-inch mesh, while the small nets used to sweep the porpoises were of heavy material, 9-inch mesh.

Clark (1887a) described essentially the same technique, while Townsend (1914b) indicated that in the latter phases of the fishery they were using a single net about 1000 yd long, which was set parallel to the shore outside the school, then hauled ashore both in front of and behind the school.

Sparks (1885b) indicated that at some point the Cooke Patent Net was tried in this fishery. This was a large net of 8-inch square mesh with two wings 1000 yd long and 24 ft deep and a bag 120 ft long, 60 ft wide, and 24 ft deep. It was developed for the Cape May porpoise fishery and was set in the path of the school with the wings extending along either side of the school. In the Cape May fishery it was hauled by a steamer, forcing the porpoise into the bag, which was then closed. There is no indication that its use at Hatteras was extensive, perhaps due to the difficulty of operating a steamer along that shore.

Catch Sizes

True (1885c) stated that schools of up to 600 were sometimes surrounded by the large net, of which "50 or 60 are hauled ashore at a time." I would interpret this to mean that the total catch from the school of 600 was 50-60, not that 50-60 were taken with each sweep of the small seines. This is comparable to the figure given by Sparks (1885b) of 25 taken from a set on a school of 250. Thus, with the techniques used during the peak of the fishery, approximately 10% of the school was taken in a set, the remainder escaping by either diving under the net or jumping the cork line.

True (1891) examined five catches during the period May 14-19, 1886, ranging from 14 to 66 animals. Townsend (1914b) mentioned a haul of 33 porpoises in November. A news article in the Grand Rapids, Mich., *Democrat* of June 4, 1899 gave the following figures: three nets worked by three crews of 22 men each, an average of 4-5 catches per week in good weather, and an average catch of 80 porpoises. It is not clear, however, to which period of the fishery these data pertain. The single set catch of 170 given by Stick (1958) for November 1, 1886, is the highest known single catch for the fishery.

The figures available for catches by year or season are given in Table 2. There is much con-

TABLE 2. Catch data for Hatteras *Tursiops truncatus* fishery.

Date	Catch data
1797-1860	?irregular operation at moderate level (4-500/season) (Clark 1887a; Stick 1958)
1860-70?	Inactive
1871-?	Fishing resumed at Cape Lookout
1883-84	?840
1884-85	1268 (True 1891)
1885-86	2049 (Stick 1958)
1886-87	?6450 (2293)
1888	?
1889	?2283 (Stevenson 1904a)
1890	?1747 (Stevenson 1904a; Stick 1958)
1890-93	?closed in 1893
1894-1902	Inactive
1903-06	?inactive
1907	70 (data thru 1914 from Townsend 1914b)
1908	591
1909	1550
1910	1278
1911	826
1912	467
1913	400
1914	1073
1915-27	?about 500 per year (Kellogg 1927)
1928	In operation (files U.S. National Museum)
1929	Closed sometime during this year (Kellogg 1940).

TABLE 3. Size and sex distribution of *Tursiops truncatus* in catches (True 1891).

Date	Males	Females	Largest	Smallest
May 14, 1886	20	14	9 ft 10 inches (300 cm)	6 ft 7 inches (201 cm)
May 15, 1886	10	10	9 ft 4 inches (284 cm)	5 ft 4 inches (163 cm)
May 15, 1886	9	8		
May 19, 1886	6	8	9 ft 3 inches (282 cm)	3 ft 7 inches (109 cm)
May 19, 1886	31	35	8 ft 5 inches (257 cm)	5 ft 3 inches (160 cm)
Totals	82	75	9 ft 10 inches (300 cm)	3 ft 7 inches (109 cm)

fusion in the literature regarding these figures, as summarized in the following paragraphs.

G. L. Sparks, in the Philadelphia Evening News, October 25, 1885, stated that they "have captured thus far 2,108, and expect to go at it again on the first of the coming month." This must include the 1884-85 catch of 1268 given by True (November 15, 1884 to May 15, 1885) and either an earlier catch from the 1883-84 season, or a catch from May 15 to October 25, 1885. The former seems more likely, as there is no indication of any summer catches having been made at Hatteras. Thus, there may have been a catch of 840 in 1883-84. With the later figures, it is not clear whether the statistics pertain to the catch season or to a calendar year. The figures for 1880-90 are useful primarily as a general indication of the magnitude of the fishery. While it is not possible to tell which time period the 1907-14 figures pertain to, they are all from the same source and are thus internally consistent.

A letter from F. C. Zimmerman to F. W. True indicated that the weather and leather prices were bad in 1888-89, the latter perhaps contributing to the closure of the fishery in 1893.

There are several published catch figures that appear to be erroneous or to have no basis. Stevenson (1904b) cites a catch of "about 20,000" in 1887. It is difficult to see where he derives this figure (Mitchell 1975, p. 85), as in an earlier paper (Stevenson 1904a) he gives a catch of 6450 for the same year. Tomilin (1957) cites a catch of 12,000 for 1884-85. This is clearly a misinterpretation of his source (Norman and Fraser 1937; not Fraser 1937 as cited by Tomilin), which gave a catch of 1200 for that period.

School Composition

Size and sex distribution of several catches (Table 3) for the month of May, 1886, were given by True (1891). These figures indicate a nearly even distribution of sexes and a wide size range. True (1891) noted, however, that these animals may have represented heterogeneous groups on the southern end of the northward mi-

gration. According to information he received from the fishermen, the groups taken early in the season were more homogeneous, some consisting almost entirely of old males, some almost entirely of young males, etc. Townsend (1914b) examined a catch of 51 animals on November 12, 1913, consisting of 34 females and 17 males. He also noted that the groups were more mixed in the spring and more homogeneous in the fall, but it is not clear whether this was an independent observation or derived from True's report.

Reproduction, Fetuses

Information received from the fishermen at the Hatteras fishery indicated that fetuses were generally small in September, increasing in size as the season progressed (True 1891). The length figures available are as follows (figures in parentheses have been converted from English to metric):

mid-Aug. 1884	12 cm	True (1885a)
		(Cape May)
Nov. 12, 1913	(38 cm), (32 cm)	Townsend (1914b)
Apr. 30, 1914	nearly (122 cm)	" "
Apr. 30, 1914	Fetuses less than (46 cm)	" "
May 1886	fetus skulls	
	240, 163 mm	True (1891)

True (1891) noted considerable variation in both the size of the fetal skulls that he examined and in the lengths of nursing or freshly weaned animals, from which he concluded that there was an extended breeding season. This can be seen in the figures for November 12, 1913 and May 1886 given above. The disparity in lengths reported by Townsend for April 30, 1914, however, might indicate two separate peaks of breeding activity. Townsend (1914b) observed captive animals from Hatteras mating in January and again in March and April. Ridgway (1972) also provided evidence suggesting two breeding peaks in *Tursiops truncatus*.

Lactation

On May 19, 1886, True (1891) examined a

catch of porpoises at Hatteras containing 35 females. Of these he found nine to be lactating, but it is not clear how many were adults or whether all of the adult females were examined. Townsend (1914b) examined a catch at Hatteras on November 12, 1913, consisting of 34 females and 17 males, and noted that: "All of the females examined were in milk, and the females killed were not only in milk but also contained young."

During this visit to Hatteras, five adult and five young animals were taken alive for the New York Aquarium, accounting for the differentiation between animals examined and animals killed. If we assume that equal numbers of the sexes were taken alive, then about 29 females were killed. However, some of these were not adult, making it impossible to arrive at the actual number of lactating and pregnant females, though it was probably on the order of 15.

True (1885a) examined two adult females taken in the Cape May fishery and found one of them lactating and the other with a 12-cm fetus.

Food Habits

There are very few data available on the food habits of the Hatteras *Tursiops*. Townsend (1914b) was told by fishermen that they fed primarily on squeteague or weakfish. True (1885a) found common gunnard (*Prionotus carolinus*) in the stomachs of both of the adult females that he examined at the Cape May fishery.

Economic Basis

Utilization of the catch in the early years of the fishery (1810-60) has not been documented, but presumably blubber or body oil was the chief product. This may have been consumed locally or sold along with oil from the sporadic shore fishery for right whales. The body oil brought the same price as whale oil in the later phases of the fishery (\$0.35-0.40/gal. True 1885e; Stevenson 1904a). True (1891) gave the average oil yield in the winter as 6-8 gal/porpoise, dropping to 3 or 4 gal/porpoise late in the spring. Stevenson (1904a), however, gave the following yields: 10,460 gal from 6,450 porpoise, 3897 gal from 2283 porpoise, and 2746 gal from 1747 porpoise. These figures are from the peak of the fishery, 1887-90, and are much lower yields than those given by True (amounting to an average of less than 2 gal/porpoise). At this later date, however, the hides were being utilized for leather and much of the oil may have been lost in their processing. The highest oil yield given is 24 gal from a 12-ft animal (True 1891). This seems excessive, as

none of the documented animals were over 10 ft. The offshore populations of *Tursiops* in the western North Atlantic are larger, as are the animals found along the coast of Europe. This individual may have been one of these, or may have been some other species, such as a young ziphiid.

In the early 1800s it was discovered that porpoise jaw oil was an excellent lubricant. Shortly thereafter pilot whale melon oil was found to possess the same qualities and these oils began to replace olive oil, which had been used for watches and fine instruments. The demand for these oils remained high until recently when they were largely replaced by synthetic oils. Clark (1887a) gave a range of \$5-15/gal for these oils, while Townsend (1914b) gave a price of \$20/gal. These are probably the prices for the raw oil from the fishermen, and the price of \$60/gal given by Sparks (1885b) was perhaps the price of the finished product on the retail market. Sparks (1885b) gave the average jaw oil yield as 4 oz per porpoise, although in my experience it might be closer to double that amount.

During the peak of the Hatteras fishery, hides for leather were one of the principal products. According to Stevenson (1904b) the suppleness and durability of the leather made it particularly desirable for shoes. It also possessed the property of swelling when wet, allowing very little water to penetrate the shoe. The same author gave the value of a green hide as about \$2 per side (there being two "sides" taken from each porpoise), and a tanned hide as \$10-12 per side.

The remains of the carcasses were sometimes processed as fertilizer. The financial prospectus of the Porpoise Fishing Co., of Cape May, New Jersey, 1884, gave an average value of \$2.50 per porpoise for this product. The firm of Cooke and Sparks, who operated the Hatteras fishery during its peak, also attempted to market various forms of porpoise meat for human consumption. In a news article in the Philadelphia Evening News, October 25, 1885, G. L. Sparks stated that the firm had sold 25,000 lb of cured and smoked meat, but did not mention the value. There are vague indications (Sparks 1885a) that this marketing effort was unsuccessful, and there was no mention of it after 1885.

Other Species Taken

There are two mandibles of *Steno bredanensis* in the collection of the Museum of Vertebrate Zoology, University of California at Berkeley (MVZ 23715, 23716), which were collected in 1915 from the Hatteras fishery. This is the only documented instance of a species other than *Tursiops truncatus* being taken in this fishery.

True (1885e) reported a "large series of skulls of *L. perspicillatus* [= *Lagenorhynchus acutus*] was sent to the Museum [United States National Museum] a number of years ago by Drs. Coues and Yarrow, from Fort Macon, which is not very far distant from Hatteras." True suspected that the Hatteras fishery was based on *L. acutus*, and the purpose of his visit to the area in 1884 was to obtain material of that species. Upon examination of the Fort Macon skulls, they proved to actually belong to *Tursiops truncatus*.

As noted earlier, the 12-ft animal reported by True (1891) may not have been a *Tursiops*, but some unidentified species.

Cape May, New Jersey Porpoise Fishery

This fishery was organized in 1884 and apparently operated for 2 yr (Sparks 1885b). The fishery was operated by the firm of Cooke and Sparks (the Porpoise Fishing Co.), using the large Cooke Patent Net. According to Sparks (1885b), the venture failed after the loss of two of the steamers used to haul the large net. Sparks (1885b) gave a total catch of about 120 porpoise, while True (1884) reported that as of August 1884, they had taken over 200 for the year. Even though the data are poor, they serve to indicate that this was not a major fishery.

Long Island Fishery

In the late 18th century there was an apparently substantial porpoise fishery on the eastern end of Long Island (L'Hommedieu 1794; DeKay 1842). The technique employed was essentially the same as in the Hatteras fishery, with a long net set parallel to the shore, the school being trapped by two smaller nets set off either end. The porpoise were taken both for oil and leather, as at Hatteras.

The species taken is not well described, and hence open to question. It was almost certainly not *Phocoena* as indicated by DeKay. The average oil yield of 6 gal is much too high for *Phocoena*, and is about the same as that obtained from *Tursiops* in the Hatteras fishery. *Tursiops* does not frequent the coast of Long Island in any numbers today, but neither does any other small cetacean. From the manner in which they were taken, it is more likely that the species was *Tursiops truncatus* than the next most likely species, *Lagenorhynchus acutus* or *L. albirostris*, both of which may have been fished elsewhere, but not usually by net.

Unfortunately, no data are given on catch sizes, fishing season, or duration of the fishery; DeKay's (1842) work contains essentially an abstract of

L'Hommedieu's (1794) paper which dealt only with fishing technique.

Effect of These Fisheries on the Populations

None of the data for the *Tursiops* fisheries are adequate to allow an evaluation of catch effort trends. In all cases the fisheries were subject to catch variation brought on by weather conditions, and to effort variations as a result of economic factors. The close of the early phase of the Cape Hatteras fishery (1797–1860) was more likely due to socioeconomic factors than to a decline in the stock. Likewise, there is some indication that economics played a role in the close of the fishery in 1893, though the high catches in this period may well have reduced the population to the point where fishing became economically difficult.

The extremely high pregnancy and lactation figures given by Townsend (1914b) may indicate a population reacting to relatively heavy pressure. Unfortunately the figures given by True (1891) are not complete enough to allow a comparison between early and late phases of fishing. While the high catches in the period 1883–93 may have had a considerable effect on the population at that time, it was clearly able to recover to the point where it supported another active fishery 14 yr later.

The Cape May fishery, which may have been exploiting the northern end of the same population as the Hatteras fishery, was probably small and short-lived enough to have a negligible effect on the population.

Unfortunately there are so few data for the Long Island fishery that even speculation is difficult. If this fishery were in fact based on *Tursiops truncatus*, it may have contributed significantly to the lack of that species along those shores today.

Mitchell (1975, p. 85) made a cumulative catch estimate of population size of the stock fished off Hatteras, estimating "a minimum population of 13,748, or approximately 17,000 by assuming an (unknown) catch of 3,000 for 1888."

Current Factors Affecting this Stock

Although there are no precise data, the distribution of the *Tursiops* population formerly fished at Hatteras has probably been affected by such factors as pollution and ship traffic. The latter may be particularly important, as the *Tursiops* appear to habitually follow fishing boats in the area. Shrimp trawling is quite heavy in the winter, possibly resulting in a disruption of the migration stream.

There is still a small, shore-based net fishery for

food fish in the Hatteras area, using much the same techniques as were used in the porpoise fishery. A few *Tursiops* may be killed incidental to this fishery, probably on the order of a few tens of animals or less per year.

In some areas the porpoises are considered a nuisance by fishermen and are occasionally shot (Caldwell and Caldwell 1972). It would be very difficult to estimate the mortality from this cause, but it is probably less than a hundred per year.

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