

AGE AND GROWTH OF LARGE SOUTHERN QUAHOGS FROM A FLORIDA ESTUARY¹

Carl H. Saloman and John L. Taylor

BUREAU OF COMMERCIAL FISHERIES
BIOLOGICAL LABORATORY
ST. PETERSBURG BEACH, FLORIDA

ABSTRACT

Data are presented on shell dimensions, weights, and age of 93 large southern quahogs, *Mercenaria campechiensis*, collected in Boca Ciega Bay, Florida. Shell length of four clams exceeded the previous size record for this species. The largest measured 179 mm in length, and the estimated age of the oldest was 22 years. Age of individuals was determined by counting growth lines on lateral and transverse shell surfaces. The transverse surface was exposed by sectioning. Average growth in the first 3 years produced clams 38 to 67 mm long early in the second year, 68 to 77 mm by the end of the second, and more than 77 mm in the third year. This rate of growth is at least three times that of northern quahogs.

INTRODUCTION

This report presents new information on the age and growth of southern quahogs (*Mercenaria campechiensis*) larger than 77 mm in total length (common name — chowders). A technique for determining the age of quahogs is described and a new size record for the southern quahog is recorded.

Growth of southern quahogs in Boca Ciega Bay was studied earlier by Taylor and Saloman (1968) by modal size frequency distribution, but only for clams not exceeding 6 years of age. To our knowledge there are no recorded studies of age and growth of southern quahogs beyond that age.

At one time a substantial commercial fishery for the southern quahog existed on the southwest coast of Florida near the Ten Thousand Islands, beginning in the late 1800's and continuing to about 1945 (Schroeder, 1924; Tiller, Glude and Stringer, 1952; Carpenter, 1967). The peak production from this industry was probably in 1922 when 205,625 bushels were harvested by hand and dredging. The last significant productive year was in 1945 when 78,000 pounds of meats were harvested. The extent and capabilities of this past fishery have stimulated interest in exploration of

Florida waters for natural clam beds and in quahog culture. The morphometric information obtained in this study is useful in estimating age classes and potential meat production of clams in natural and planted beds. These data also show annual growth increments that may be expected in the culture of quahogs.

PROCEDURE

Ninety-three quahogs were collected on 18 April and 10 May 1968, by treading and raking in shallow water (less than 1 meter) on two shoals within a small embayment in northern Boca Ciega Bay — 27°49'50"N. Lat.; 82°49'40"W. Long. (Fig. 1). Patches of sea grass, *Thalassia testudinum* and *Diplanthera wrightii*, grew on the bottom and sediments ranged from firm sand to soft, silty sand.

Shells of live and recently dead clams were cleaned before measurement of length, height and width to the nearest millimeter. Length is considered the greatest distance from the anterior to posterior margin of the valves; height is the greatest distance from the umbo to the ventral margin; and width is the greatest distance through both valves perpendicular to the other two axes. To record total weight and shell weight, live individuals were weighed on a solution balance to the nearest gram before and after the meat was shucked.

Age and growth of 93 quahogs between 6 and

¹ Contribution No. 53, Bureau of Commercial Fisheries Biological Laboratory, St. Petersburg Beach, Florida.

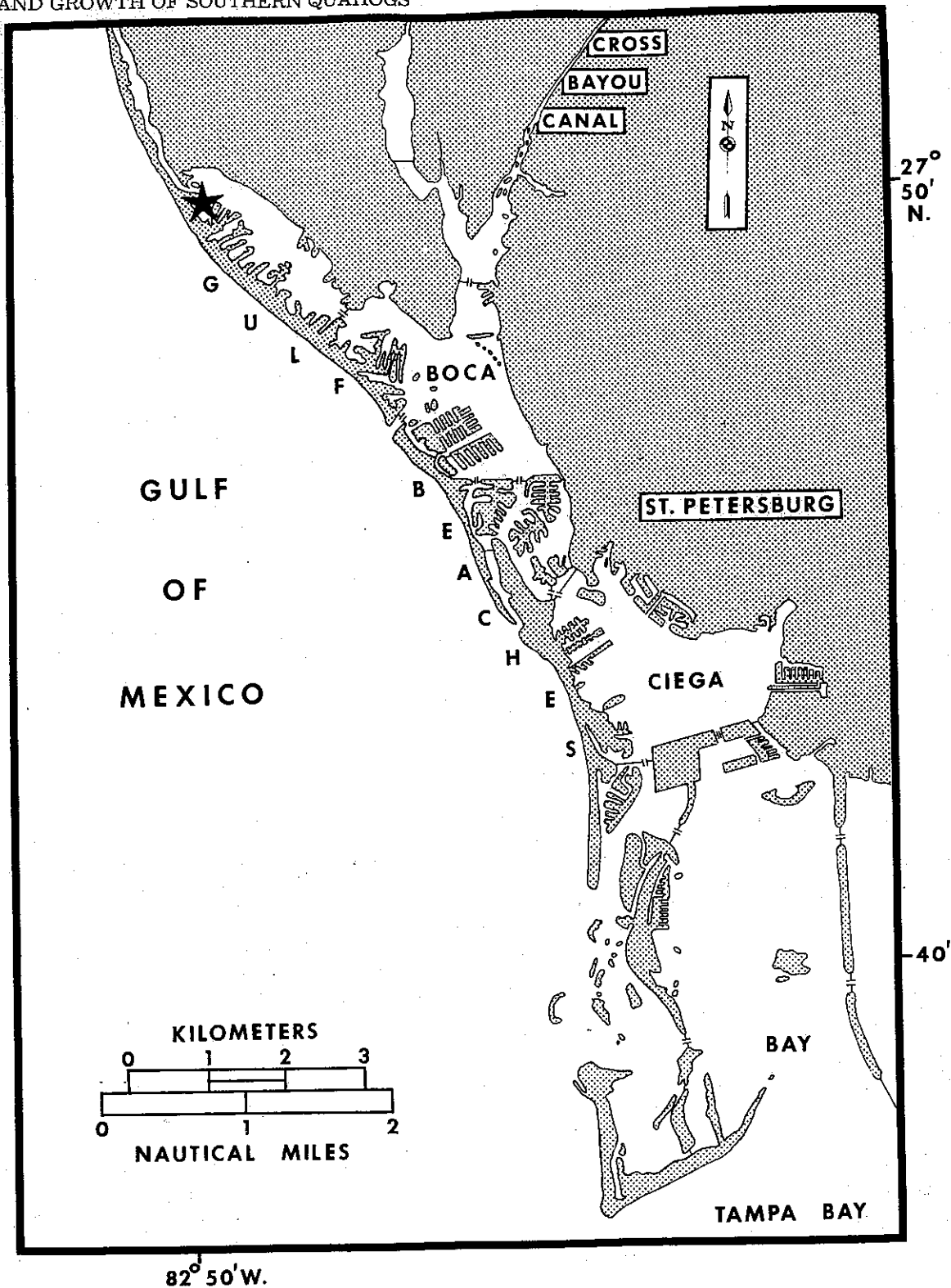


FIG. 1. Location of sampling site (star) of large southern quahog clams in Boca Ciega Bay, Florida.

22 years old were determined by counting annuli and measuring the distance between successive annuli from the umbo to the ventral edge. The position of closely set concentric grooves and ridges that mark the termination of annual growth on lateral shell surfaces was corroborated by examining the surface of transverse shell sections, as suggested by Shuster (1957) and illustrated in Figures 2 and 3. Pannella and Mac-

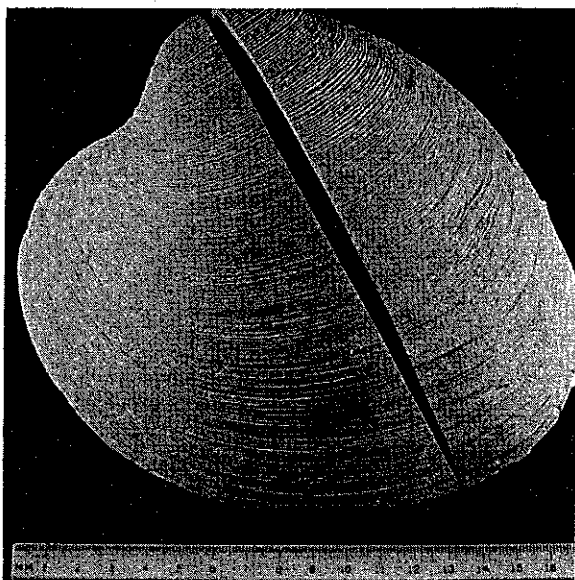


FIG. 2. Largest live southern quahog collected (shell length, 172 mm). Transverse cut was made with a diamond-toothed saw between umbo and ventral margin.

Clintock (1968) have further demonstrated (by cutting the clam from the umbo to ventral edge and examining the transverse surface) that *M. mercenaria* produces annual, breeding, lunar month, tidal, bidaily and daily growth patterns. The use of both criteria has increased the accuracy substantially over the use of one method.

Transverse sections were prepared with a diamond-toothed saw. This method of cutting did not cause cracking and was generally better than the embedding procedures suggested by Shuster (1957). Because of shell curvature, cumulative measurements of yearly growth gave a total shell height about 15% greater than the height determined from a single measurement between the umbo and ventral edge (Table 1).

Age determination based solely on lateral shell rings has been criticized by Ansell (1968). In earlier studies, Belding (1912) and Kerswill² counted growth lines on the outer shell surface



FIG. 3. Transverse surface of southern quahog showing recurved ventral lip and relation of annuli on external and transverse surface (black lines).

to determine age of the southern quahog, *M. mercenaria*; they found none over 25 years old. The same method has also been used to determine the age of pismo clams (Weymouth, 1923) and Pacific cockles (Weymouth and Thompson, 1931).

RECORD-SIZE CLAMS

Four southern quahog clams exceeded the previous record of length. The largest live clam had a record shell length of 172 mm (6.8 in) and weighed 2,110 g (4.6 lbs); the second was 169 mm long (6.6 in) and weighed 2,485 g or about 5.5 lbs. Two large dead clams (valves and ligaments intact) were also collected. The largest measured 179 mm and the other 173 mm. The previous record of 168 mm (6.6 in) was reported for a specimen taken in the same collecting area (Sims, 1964), but the weight of that clam was 2,951 g (6.5 lbs).

The age of the oldest live clam collected was estimated to be 20 years. Valves of two recently dead clams indicated ages of 21 years and the age of a third was estimated at 22 years. Because of the fast growth rate and individual variation, the largest clams are not always the oldest. The largest collected (179 mm total length) was only 14 years old (Table 1).

² Kerswill, Charles James. 1941. Some environmental factors limiting growth and distribution of the quahog *Venus mercenaria* L. Doctoral Thesis; Univ. Toronto, 122 p.

TABLE 1. Age, shell dimensions and weight of large southern quahog clams from Boca Ciega Bay, Florida.

Age group and item	Length mm	Height* mm	Accumulated height** mm	Width mm	Total weight g	Shell weight g	Weight of meat and fluids g
VI Group							
Average	129	123	138	79	—	—	—
Range	126-134	120-126	133-143	79	—	—	—
Number	3	3	3	1	—	—	—
VII Group							
Average	120	117	136	76	866	608	258
Range	117-124	112-120	129-140	72-79	844-887	568-648	239-276
Number	3	3	3	3	2	2	2
VIII Group							
Average	124	123	141	78	—	—	—
Range	113-134	114-132	128-154	74-81	—	—	—
Number	2	2	2	2	—	—	—
IX Group							
Average	140	132	151	81	1,077	720	358
Range	131-147	128-136	137-158	79-82	995-1,159	688-751	307-408
Number	6	6	6	2	2	2	2
X Group							
Average	139	133	161	—	—	—	—
Range	138-139	129-136	157-165	—	—	—	—
Number	2	2	2	—	—	—	—
XI Group							
Average	140	136	160	87	1,290	820	470
Range	127-152	127-146	149-170	82-95	1,001-1,640	693-947	318-693
Number	8	8	8	5	5	5	5
XII Group							
Average	144	139	165	89	1,308	901	407
Range	126-158	124-153	140-183	85-93	1,195-1,464	776-1,025	383-439
Number	11	11	11	6	4	4	4
XIII Group							
Average	143	140	169	93	1,511	1,059	453
Range	124-161	123-158	145-189	84-104	1,039-2,001	763-1,387	276-614
Number	13	13	13	8	7	7	7
XIV Group							
Average	150	146	173	94	1,492	1,066	427
Range	133-179	130-168	156-194	86-102	1,167-1,912	826-1,378	341-534
Number	10	10	10	8	7	7	7
XV Group							
Average	147	143	173	96	1,536	1,150	386
Range	129-167	129-158	160-195	90-104	1,215-1,915	961-1,390	182-548
Number	9	9	9	5	5	5	5
XVI Group							
Average	147	145	172	97	1,709	1,212	497
Range	126-161	126-156	153-182	87-106	1,536-1,870	1,094-1,357	429-579
Number	10	10	10	8	7	7	7
XVII Group							
Average	159	154	182	101	1,938	1,333	605
Range	148-168	146-164	172-201	97-105	1,628-2,247	1,117-1,549	511-698
Number	6	6	6	2	2	2	2
XVIII Group							
Average	157	153	172	96	1,873	1,275	599
Range	156-158	152-153	171-173	95-97	1,821-1,925	1,248-1,301	520-677
Number	2	2	2	2	2	2	2
XIX Group							
Average	171	171	186	101	2,485	1,865	620
Range	169-173	170-172	181-190	99-102	2,485	1,865	620
Number	2	2	2	2	1	1	1
XX Group							
Average	166	158	188	102	2,037	1,421	615
Range	158-172	153-161	181-194	94-109	1,646-2,354	1,131-1,681	515-673
Number	3	3	3	3	3	3	3
XXI Group							
Average	161	158	189	—	—	—	—
Range	154-168	152-164	185-193	—	—	—	—
Number	2	2	2	—	—	—	—
XXII Group							
Average	154	153	181	—	—	—	—
Range	154	153	181	—	—	—	—
Number	1	1	1	—	—	—	—

*Height determined by a single measurement from umbo to ventral edge.

**Height based on accumulation of yearly increments of growth.

AGE AND GROWTH

In Boca Ciega Bay, Florida, the southern quahog grows rapidly through its life. Very old clams, however, decrease in shell length and height with increasing age as shell margins recurve and became thick (blunt) — Tables 1 and 2. A more realistic measure of shell growth with age was obtained by recording shell height as the actual and summing the cumulative distance between successive annuli (Tables 1 and 2). A plot of these data produces a growth curve of the normal type that shows rapid growth among young animals followed by a progressively slower growth at least to age 22 (Fig. 4).

The relation of shell height to age shows that clam growth in the first 3 years is rapid and variable (Table 2). Assuming a life expectancy of at least 22 years, a clam exceeds 50% of its expected height in the third year and over 70% by the time it reaches age 5 (Fig. 4). Comparative height and length data for these clams and over 5,000 others from Boca Ciega Bay³ show that clams

attain an average length of 38 to 67 mm (little neck) early in the second year, 68 to 77 mm (cherrystone) by the end of the second year and

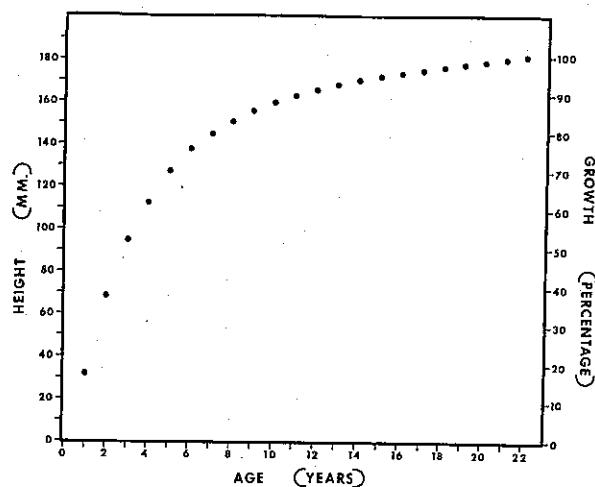


FIG. 4. Mean growth and percentage of maximum height by age of southern quahog clams from Boca Ciega Bay, Florida.

³ Unpublished data on file at the Bureau of Commercial Fisheries Biological Laboratory, St. Petersburg Beach, Florida.

TABLE 2. Mean growth in height*, range and standard deviation by age of large southern quahog clams from Boca Ciega Bay, Florida.

Age	Number of Clams	Increment of height		
		Mean (mm)	Range (mm)	Standard deviation
I	93	31.5	10.2 - 63.7	13.8
II	93	37.4	12.8 - 61.0	12.6
III	93	26.0	11.1 - 53.6	9.1
IV	93	17.8	5.5 - 31.0	5.1
V	93	15.0	4.0 - 25.3	5.4
VI	93	10.4	1.4 - 21.7	4.6
VII	90	6.9	1.5 - 17.2	3.4
VIII	87	5.9	1.3 - 17.1	3.3
IX	85	5.1	1.4 - 19.9	3.3
X	79	3.8	1.0 - 9.7	2.3
XI	77	3.2	0.8 - 12.8	2.0
XII	69	2.8	0.6 - 8.6	1.6
XIII	58	2.5	0.9 - 9.0	1.6
XIV	45	1.9	0.7 - 7.6	1.2
XV	35	1.8	0.6 - 7.3	1.5
XVI	26	1.5	0.5 - 4.6	0.3
XVII	16	1.4	0.7 - 3.0	0.2
XVIII	10	1.7	0.5 - 4.4	1.5
XIX	8	1.2	0.4 - 3.2	0.3
XX	6	1.2	0.4 - 2.4	0.2
XXI	3	1.0	0.5 - 1.4	0.1
XXII	1	1.7	1.7	0.0

*Height based on yearly increments of growth.

above 77 mm long (chowder) in the third year (grade classifications by Godwin, 1967). This growth rate is about $3\frac{1}{2}$ times greater than that recorded for northern quahogs (Kerswill²) and more than twice that of northern quahogs transplanted to southern waters (Menzel, 1961).

LITERATURE CITED

- Ansell, A. D. 1968. The rate of growth of the hard clam *Mercenaria mercenaria* (L.) throughout the geographical range. J. Cons. 31:364-409.
- Belding, David C. 1912. A report upon the quahaug and oyster fisheries of Massachusetts, including the life history, growth and cultivation of the quahaug (*Venus mercenaria*), and observations on the set of oyster spat in Wellfleet Bay. Mass. Div. Mar. Fish. Contrib. No. 12, 134 p.
- Carpenter, James S. 1967. History of scallop and clam explorations in the Gulf of Mexico. Commer. Fish. Rev. 29(1):47-53.
- Godwin, Walter F. 1967. Preliminary survey of a potential hard clam fishery. Ga. Game Fish Comm., Mar. Fish. Div. Contrib. Ser. No. 1, 23 p.
- Menzel, R. Winston. 1961. Seasonal growth of the northern quahog, *Mercenaria mercenaria* and the southern quahog, *M. campechiensis*, in Alligator Harbor, Florida. Proc. Nat. Shellfish. Ass. 52:37-46.
- Pannella, Giorgio and Copeland MacClintock. 1968. Biological and environmental rhythms reflected in molluscan shell growth. J. Paleontol. 42:64-79.
- Schroeder, William C. 1924. Fisheries of Key West and the clam industry of southern Florida. Rep. U.S. Comm. Fish., 1923, append. 12, 74 p.
- Shuster, Carl N., Jr. 1957. On the shell of bivalve mollusks. Proc. Nat. Shellfish. Ass. 47:34-42.
- Sims, Harold W., Jr. 1964. Large quahog clams from Boca Ciega Bay. Quart. J. Fla. Acad. Sci. 27:348.
- Taylor, John L. and Carl H. Saloman. 1968. Benthic project, p 3-5, figs. 2-7. In J. E. Sykes (ed.), Report of Bureau of Commercial Fisheries Biological Laboratory, St. Petersburg Beach, Florida, fiscal year 1967. U.S. Fish and Wildlife Service, Circ. 290.
- Tiller, Richard E., John B. Glude and Louis D. Stringer. 1952. Hard-clam fishery of the Atlantic coast. Commer. Fish. Rev. 14(10):1-25.
- Weymouth, Frank W. 1923. The life history and growth of the Pismo clam (*Tivela stultorum* Mawe). Calif. Dep. Fish Game Fish. Bull. 7, 120 p.
- Weymouth, Frank W. and Seton H. Thompson. 1931. The age and growth of the Pacific cockle (*Cardium corbis*, Martyn). U.S. Fish and Wildlife Service, Fish. Bull. 46:633-641.

