

## Subspecific Status of *Argopecten irradians concentricus* (Say, 1822) and of the Bay Scallops of Florida

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### ABSTRACT

Nei genetic distances between Florida and North Carolina populations of bay scallops, all putatively *Argopecten irradians concentricus*, are greater than distances between the North Carolina population and populations of *A. i. irradians* from New York to Massachusetts. The subspecies *A. i. concentricus* is probably untenable. Evidence for a subspecies, *A. i. taylorae*, in Florida and the eastern Gulf of Mexico is discussed.

**Key words:** *Argopecten*, bay scallops, genetics, Pectinidae, subspecies.

### INTRODUCTION

Bay scallops, *Argopecten irradians* (Lamarck, 1819), range from New England to Florida, Texas, and north-eastern Mexico. Northern, southern, and western populations have been accorded subspecific rank as *A. i. irradians*, *A. i. concentricus* (Say, 1822), and *A. i. ampliplicostatus* (Dall, 1898) (Clarke, 1965; Waller, 1969). We have found no morphometric or genetic characters to separate scallops of a recently proposed fourth subspecies, *A. i. taylorae* Petuch, 1987, from other Florida populations (Marelli *et al.*, 1996) customarily assigned to *A. i. concentricus*. However, our work shows that Nei (1972) genetic distances between Florida populations and a North Carolina population of *Argopecten irradians*, all putatively of *A. i. concentricus*, are greater than distances between that North Carolina population and populations of *A. i. irradians* from Massachusetts, Connecticut, and New York (figure 1), prompting us to review and reassess the subspecific status of *A. i. concentricus*.

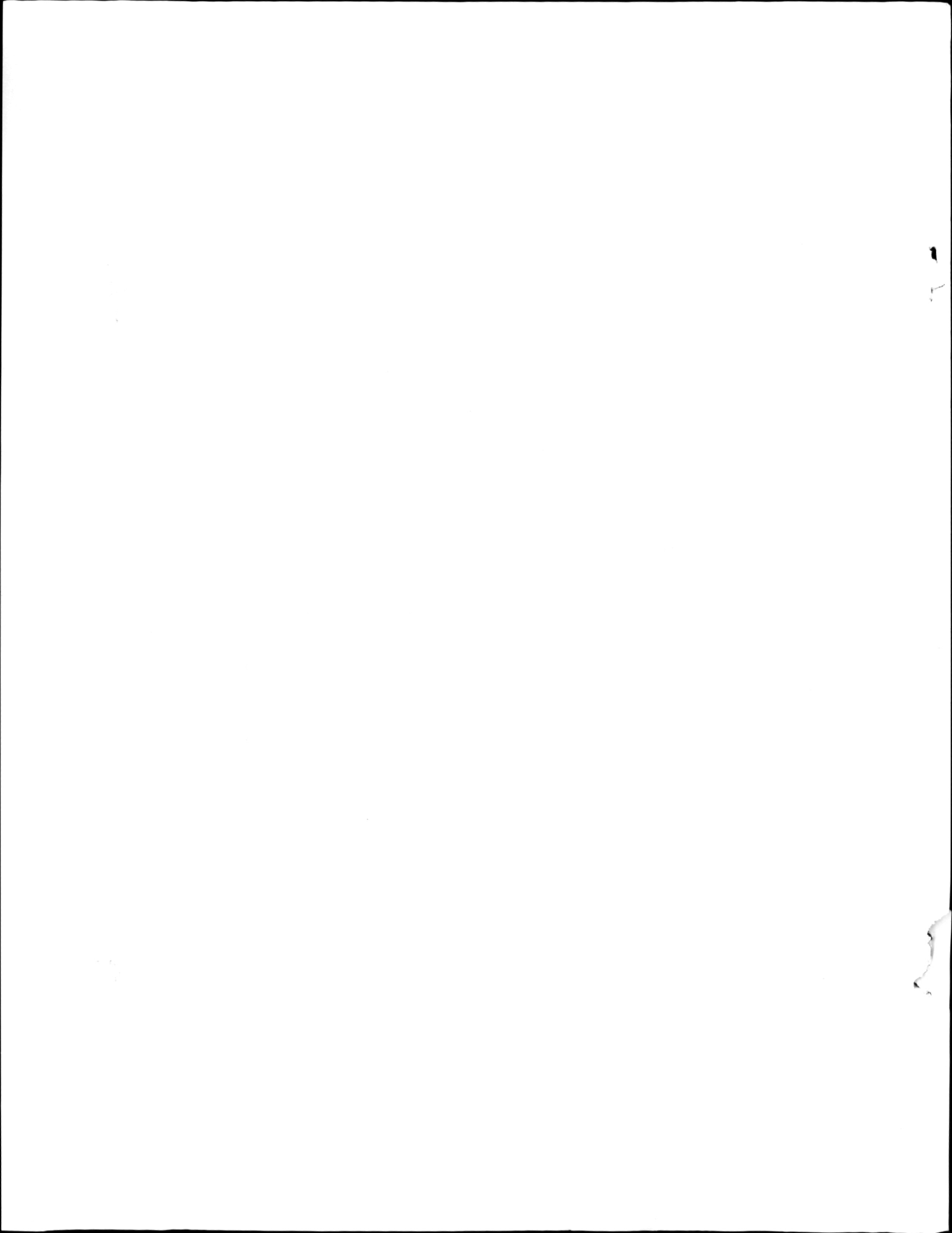
Say (1822) described *Pecten concentricus* based upon

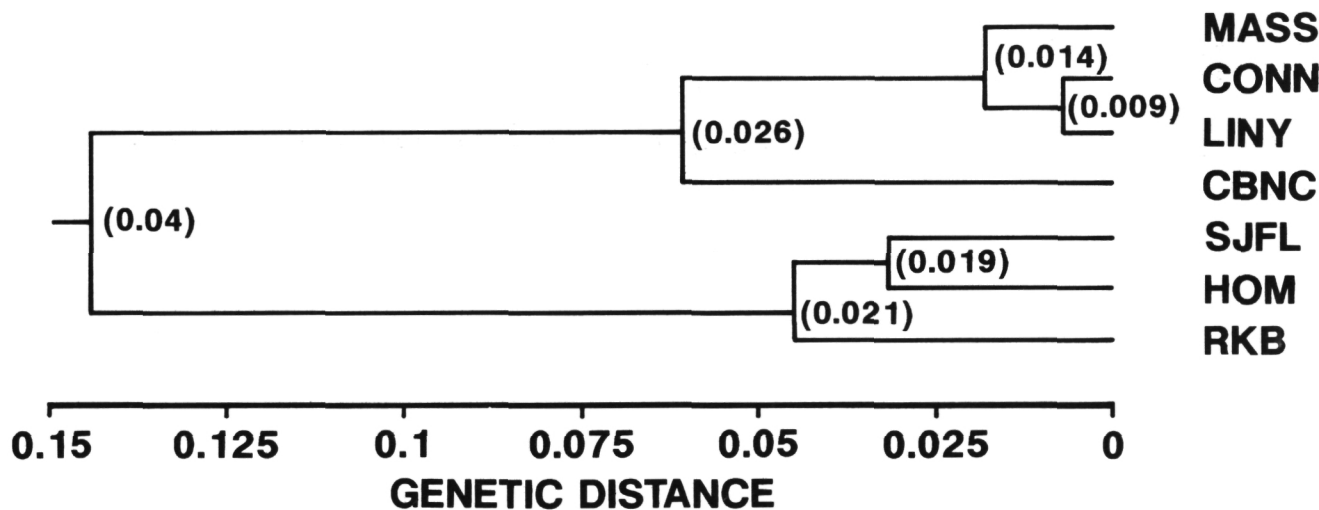
specimens from the coast of New Jersey and also recognized as distinct a variety from New England that he named *Pecten borealis*; the latter name is now known to be a junior synonym of *A. i. irradians*. Because Say's specimens of *P. concentricus* are lost, Clarke (1965) selected a neotype from Great Egg Harbor near Atlantic City in southeastern New Jersey, thereby fixing the type locality. Clarke also restricted the type locality of *P. irradians* to Waquoit Bay near Falmouth, Massachusetts.

Clarke (1965) evaluated the status of subspecific units among bay scallops by comparing four "primary characters" [plical count; width/length; height/length; and color (% white)] of shells from 23 populations throughout the range of what he called "the *Argopecten irradians* superspecies." Clarke's results, derived from relatively few specimens ( $\bar{x} = 13$ ) of disparate sizes (height range: 17.7 to 80.6 mm), must be viewed with uncertainty because of our findings of allometric variability among individual populations (Marelli *et al.*, 1996). Nevertheless, Clarke's four samples from the "New Jersey coast"; Atlantic City, New Jersey; Sinepuxent Bay, Maryland; and Hog Island, Virginia are instructive in understanding his concept of *A. i. concentricus*. The New Jersey coast sample (depicted as northern New Jersey but actually unlocalized) had characters consistent with four other samples from Massachusetts and Rhode Island (i.e., *A. i. irradians*); the Atlantic City and Sinepuxent Bay samples shared characters of both the more northern and more southern (North Carolina) samples; and the Hog Island sample grouped with two samples from North Carolina, which in turn most resembled five samples from the eastern Gulf of Mexico between Sanibel Island, Florida, and Ft. Morgan, Alabama. A specimen from Chandeleur Island, Louisiana, was depicted as intermediate between those of eastern and western Gulf (Matagorda, Texas, to Tampico, Mexico; i.e., *A. i. ampliplicostatus*) populations, but its plical count was clearly assignable to the eastern group.

Clarke interpreted his results to indicate that northern,

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**Figure 1.** UPGMA tree constructed from the Nei (1972) genetic distance matrix for populations of *Argopecten irradians*. See Marelli *et al.* (1996) for methods. Abbreviations are MASS: Martha's Vineyard, Massachusetts; CONN: Niantic River, Connecticut; LINY: Orient Harbor, Long Island, New York; CBNC: Core Banks, North Carolina; SJFL: St. Joseph Bay, Florida; HOM: Homosassa Bay, Florida; RKB: Rabbit Key Basin, Florida. Numbers in parentheses are standard errors of branching points estimated using procedures of Nei *et al.* (1985).

southern, and western populations of *A. irradians* are morphologically dissimilar throughout most of their ranges but that they intergrade between New Jersey and Virginia and again in Louisiana. Despite the transitional features of scallops in the type population, Clarke tried to maintain nomenclatural stability by retaining the name *concentricus* for the economically important subspecies of the southern United States. In retrospect, Clarke's findings seem to have provided more support for the existence of clines than for the existence of subspecies.

The subspecies concept is regarded by some as arbitrary because it attempts to separate populations that, in fact, may show gradual transitions in morphology, physiology, and genetics over the range of a species (Wilson & Brown, 1953; Endler, 1977). The classification of *Argopecten irradians* exemplifies difficulties inherent in attempts to distinguish such populations. The genetic distances we report for bay scallops from Florida to Massachusetts could indicate a cline among populations between which no clear boundaries exist, and that is probably the case among the Atlantic coast populations north of Florida. The transitional nature of morphological characters of the type population of *A. i. concentricus* seems to support that explanation, as do genetic similarities we found among populations between North Carolina and Massachusetts. Thus, the concept of *A. i. concentricus* as a subspecies seems untenable.

The subspecies concept gains strength, however, when it is applied to populations that are separated by distributional gaps or barriers that constrain contact (*sensu* Mayr, 1969). Waller (1969) described a distributional gap of approximately 764 km (475 miles) between the easternmost population of *A. i. amplicostatus* and the westernmost population he considered to represent *A. i. concentricus*, and he proposed that the Mississippi Delta acts

as a barrier to genetic interchange between those stocks. Thus, subspecific designations for those populations seem appropriate.

A distributional gap of similar magnitude in the southeastern United States has received less attention, perhaps because it contains no obvious barrier. The northernmost population of bay scallops along eastern Florida is at Palm Beach Inlet (Lake Worth Inlet) (Waller, 1969) near latitude 26°45'N, and the next documented occurrence of the species seems to be at Lockwood Folly Inlet near Cape Fear, North Carolina (Porter, 1974), near 33°50'N; these populations are separated by a minimum distance of nearly 800 km. Even if reports of uncommon occurrence in South Carolina (Clarke, 1965; Shoemaker *et al.*, 1978) and an unsubstantiated report from Georgia (Petuch, 1987) are considered, no population of bay scallops is known in the region between Palm Beach Inlet and the Florida-Georgia border at 30°45'N, a gap of nearly 450 km. Thus, despite reported similarities in shell morphology, the genetic gap between the North Carolina and Florida stocks is not a simple expression of distant populations separated by other, more contiguous populations distributed along a cline. Instead, the bay scallop stocks of Florida (and probably those extending to eastern Louisiana) seem to comprise an aggregation of populations isolated by large distances from other aggregations to the north and to the west, i.e., a subspecies, *sensu* Mayr (1969).

If *A. i. concentricus* is not appropriate as a name for bay scallop stocks of Florida and the eastern Gulf of Mexico, and if those stocks merit subspecific recognition, then *A. i. taylorae* Petuch, 1987, is the first available name. Another possibility, *Pecten circularis* Sowerby, 1835, was shown by Waller (1995) to be a junior synonym of *Argopecten irradians concentricus*. Dr. Waller in-

formed us (in litt., 1/30/96) that the holotype of *Pecten circularis* "compares favorably with North Carolina *concentricus* in overall shape, auricular shape, rib shape, and rib count, and it differs in these features from Gulf populations."

We advocate caution to those who might immediately apply the name *Argopecten irradians taylorae* for the Florida and eastern Gulf stocks. Our study (Marelli *et al.*, 1996) was intended only to assess differences between typical *A. i. taylorae* and other bay scallops of Florida. Those differences were refuted using analytical techniques involving both genetics and morphometrics. Similar work is needed to elucidate the genetic compositions of populations in the transition zone between New Jersey and Virginia, in South Carolina and Georgia (if such populations exist), in the region between northwestern Florida and eastern Louisiana, and in the western Gulf of Mexico (*A. i. amplicostatus*) to provide perspective for evaluating genetic distances among all of the populations before the question of subspecies is resolved.

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