LABORATORY REFERENCE DOCUMENT NO. 80-32

EVALUATION AND STATUS OF OCEAN QUAHOG, ARCTICA ISLANDICA (LINNAEUS) POPULATIONS OFF THE MIDDLE ATLANTIC COAST OF THE UNITED STATES.

BY

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[X] Approved for Distribution

[X] Distribution to F/NWC, F/SWC, F/SEC, F/NWR1, & F/NEC (Technical Writer-Editor)

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Date 10/9/80

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Introduction

This report presents an updated evaluation of the status of ocean quahog, *Arctica islandica*, populations off the Middle Atlantic coast of the United States (Cape Cod to Cape Hatteras). Estimates of minimum population size and equilibrium yields from the Middle Atlantic resource, provided in Murawski and Serchuk (1979a), are re-examined relative to current commercial landings levels from the Middle Atlantic Fishery Conservation Zone (FCZ), and new information on ocean quahog growth rate and longevity (Jones 1980; Murawski et al. 1980; Thompson et al. 1980).

Results and Discussion

Provisional 1979 Mid-Atlantic FCZ landings of ocean quahogs totaled 31.6 million pounds (meats), a 56% increase from the 1978 reported landings of 20.3 million pounds (Table 1). During both years, total annual FCZ landings were regulated by annual quotas of 3.0 million bushels (~30 million pounds, meat weight), under a Fishery Management Plan for the Atlantic Surf Clam and Ocean Quahog Fisheries (FMP). FCZ landings accounted for 91% of the total 1979 USA commercial ocean quahog catch; in 1978, 88% of the total quahog landings was taken from the FCZ.

Based on areal expansion of average research vessel survey catch per tow data from seven cruises in offshore Mid-Atlantic waters during 1965-1977, Murawski and Serchuk (1979a, 1979b) estimated the total quahog biomass from Long Island through Delmarva to be approximately 1.5×10^6 metric tons (mt) of meat (3.3×10^9 lbs). Of this total, 46% was located off Long Island, 44% off New Jersey, and 10% off the Delmarva Peninsula (Table 2). Biomass estimates are minimum values to the extent that the survey dredge is (1) size selective, and (2) not 100% efficient in sampling full vulnerable quahogs.

Given the estimated biomass of ocean quahogs in the Middle Atlantic FCZ, Murawski and Serchuk (1979a) derived equilibrium yields (i.e., maximum sustainable yields) using the model of Gulland (1971) for virgin or unexploited fishery stocks, viz.

$$C_{max} = (.5)\ (M)\ (B_o)$$

where C_{max} = maximum sustainable yield (MSY)

M = instantaneous natural mortality rate

B_o = virgin biomass (1.5×10^6 mt, meats, for ocean quahog).

Since FCZ fishery exploitation on ocean quahogs was relatively minor prior to 1976, and survey relative abundance indices during 1965-1977 indicated little change on quahog populations over time, Murawski and Serchuk (1979a) believed Gulland's model was appropriate for calculating ocean quahog MSY values. The results of these calculations are presented in Table 3.

MSY was derived for a range of natural mortality rates (M) since empirical estimates of natural mortality were not available. Also, because dredge mortality to non-harvested quahogs was believed to be between 40 to 60% of the amount harvested (Mid-Atlantic Fishery Management Council 1977), MSY values were calculated assuming 40%, 50%, and 60% biomass losses to yield from dredge mortality (Table 3).

The MSY estimates vary from 6.6 million pounds to 100 million pounds and primarily depend on the assumed natural mortality rate. Recent age and growth studies based on external and internal growth markings (Jones 1980; Murawski et al. 1980; Thompson et al. 1980) and mark-recapture techniques (Murawski et al. 1980) indicate that ocean quahogs are among the slowest-growing and longest-lived marine organisms. Quahogs larger than 90 mm shell length, common in NMFS survey

catches in the Mid-Atlantic, are estimated to be 70 years or older. Since quahogs as large as 140 mm have been taken in the NMFS surveys, quahog longevity must be well in excess of 100 years. Accordingly, the natural mortality rate must be exceedingly low. Based on the percent of quahogs larger than 100 mm in NMFS survey size-frequency distributions, natural mortality values (M) between 0.02 and 0.027 appear reasonable. MSY estimates for these values of M range from 13.3 to 27 million pounds (Table 3).

Annual FCZ ocean quahog landings during 1977-1979 averaged 22.7 million pounds, within the range of MSY values for M = 0.027. However, most of the landings were derived from the New Jersey and Delmarva which account for 54% of the total calculated biomass from Long Island - Delmarva (Table 2). Hence, if the long-term areal exploitation pattern remains constant, MSY for the areas being fished is probably less than 15 million pounds (.54 x 26.983: Table 3).

The Gulland model for estimating MSY assumes that maximum surplus production occurs when standing stock biomass is reduced to 50% of the virgin level. For Mid-Atlantic ocean quahog populations, this premise implies that stock levels could theoretically be reduced by 1.67 billion pounds before the population level producing MSY is achieved. If a more robust approach is taken and maximum surplus production is assumed to occur when stock biomass is reduced to 2/3 of the virgin level, then 1.1 billion pounds could be harvested before the MSY population size is attained. Cumulative landings during 1976-1979 comprised 2.2% of the estimated total Mid-Atlantic quahog standing stock biomass, and 4% of the standing stock levels in New Jersey and Delmarva. Accordingly, current harvest levels (1980-1981: 35-40 million pounds per annum) should not cause irreparable harm or significant adverse effects to the resource in the immediate future. If, however, subsequent evidence suggests rapid resource depletion and little concurrent recruitment to the population, appropriate constraints on the fishery may be necessary.

References

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Table 1. Landings of ocean quahogs ($x10^{-3}$ lbs of meat) from State waters (<3 miles) and the Fishery Conservation Zone (FCZ: 3-200 miles), 1967-1979.

Year	State Waters	FCZ	Total
1967	44	-	44
1968	225	-	225
1969	639	-	639
1970	1746	-	1746
1971	2030	-	2030
1972	1400	-	1400
1973	1457	-	1457
1974	805	-	805
1975	1254	-	1254
1976	1446	4089	5535
1977	2464	16085	18549
1978	2686	20279	22965
1979	3095	31629	34724

Table 2. Minimum population biomass estimates of ocean quahogs from Long Island - Delmarva derived from areal expansion of NEFC research vessel survey mean catch per tow data obtained during 1965-1977. The percentage distribution of total biomass, by area, is also given. (From Murawski and Serchuk 1979a: Table 5).

	Minimum Biomass (Meat Weight)		Percentage of Total Biomass
Area	Metric Tons	Millions of Pounds	Long Island - Delmarva
Long Island	690,925	1523	46
New Jersey	669,942	1477	44
Delmarva	150,191	331	10
Total	1,511,058	3331	100

Table 3. Calculations of Maximum Sustainable Yield (MSY) for Ocean Quahogs from Long Island - Delmarva

(M = instanteous natural mortality rate, B_o = biomass in meat weight available to the fishery, X = proportion of virgin stock size for MSY from Schaefer yield model, P = amount of additional biomass lost from dredge mortality of unharvested quahogs expressed as proportion of amount caught)

(weights in thousands of pounds)

(M)	(B_o)	X	P	MSY
0.01(a)	3,331,127	0.5	0.4	9,993
			0.5	8,329
			0.6	6,662
0.02(b)	3,331,127	0.5	0.4	19,986
			0.5	16,655
			0.6	13,324
0.027(c)	3,331,127	0.5	0.4	26,983
			0.5	22,486
			0.6	17,989
0.05(d)	3,331,127	0.5	0.4	49,967
			0.5	41,639
			0.6	33,312
0.10(e)	3,331,127	0.5	0.4	99,934
			0.5	83,279
			0.6	66,622

(a) Equivalent to 36.8% of the population living to 100 years.
(b) Equavalent to 13.5% of the population living to 100 years.
(c) Equivalent to 6.7% of the population living to 100 years.
(d) Equivalent to 0.7% of the population living to 100 years.
(e) Equivalent to <0.1% of the population living to 100 years.

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