

Small-scale Commercial Culturing of Northern Bay Scallops, *Argopecten irradians irradians*, in Atlantic United States and Canada

CLYDE L. MACKENZIE, JR.

Introduction

This paper describes the development of a new edible northern bay scallop, *Argopecten irradians irradians*, product. The concept of culturing northern bay scallops was considered in the early 1900's by Belding (1910), but he could not raise the larvae and stated that hatchery production could not be put on a practical basis.

Clyde L. MacKenzie, Jr., is with the James J. Howard Marine Sciences Laboratory, Northeast Fisheries Science Center, NOAA, National Marine Fisheries Service, 74 Magruder Road, Highlands, NJ 07732 (email: Clyde.Mackenzie@noaa.gov).

ABSTRACT—*In recent decades, hatchery-growout culture of oysters, Crassostrea virginica, and northern quahogs, Mercenaria mercenaria, has been commercially successful in Atlantic United States and oysters in Atlantic Canada. Culturists have not had success, as yet, with northern bay scallops, Argopecten irradians irradians. Large mortalities occur during the culture process, mainly because the scallops are relatively delicate and some die when handled. In addition, too little edible meat, i.e. the adductor muscle, is produced for the culture operation to be profitable. However, three companies, one in Massachusetts, one in New Brunswick, and one on Prince Edward Island, Canada, have discovered that they can produce bay scallops successfully by harvesting them when partially- to fully-grown and selling them whole. In restaurants, the scallops are cooked and served with all their meats (adductor muscles and rims) and also with the shells, which have been genetically-bred for bright colors. The scallop seed are produced in hatcheries and then grown in lantern or pearl nets and cages to market size. Thus far, production has been relatively small, just beyond the pilot-scale, until a larger demand develops for this product.*

By using better equipment and adequate foods for feeding larvae, Loosanoff and Davis (1963) were able to bring the bay scallop and many other bivalve mollusks through their larval stages to set consistently. Their paper and another by Walne (1974) stimulated much further work to develop techniques and find the best larval foods to advance production of commercial quantities of the mollusks (Castagna and Duggan, 1971; Castagna, 1975; Rhodes and Widman, 1980).

Hatchery-growout production of bivalve mollusks now is common in numerous locations in the world. Juvenile scallops are also collected from the wild for further growth to market sizes in controlled environments, such as lantern nets, pearl nets, and trays. On a large scale, various species of scallops are cultured in China (Gou et al., 1999; Guo and Luo, 2006), Chile (von Brand et al., 2006), Mexico (Mazon-Suastegui et al., 2003), Scotland (Edwards, 1997), and in Atlantic Canada (Quebec, Newfoundland, Nova Scotia), and also St. Pierre and Miquelon, France (where North Atlantic sea scallops, *Placopecten magellanicus*, are grown) (Davidson and Mullen, 2005).

In New York and Massachusetts in the United States and in Atlantic Canada, development groups have attempted to produce the northern bay scallop commercially by growing their larvae in hatcheries and then rearing the juveniles to full market size in suspended nets and cages; only the adductor muscle of the scallop would be sold.

This species will not grow to full size during one growing season, spring through fall, and the scallops must be held over winter and grown further

during the following warmer months. When held that long, most scallops do not survive, though, and since only the scallops' adductor muscle was to be sold, this type of culture has not as yet been profitable (Castagna¹, Gaines², Rivara³, Zatila⁴).

Successful Commercial Bay Scallop Culturing

In recent years, a few small companies in Massachusetts and two–three others in New Brunswick and Prince Edward Island, Canada⁵ have tried growing bay scallop seed and then harvesting the scallops, some at smaller than usual sizes, for sale (Fig. 1). All the scallops have been bred to grow bright orange, yellow, purple, or white shells (Fig. 2), rather than the brownish and grayish shells typical of wild scallops. The beautiful design of the bay scallop shell has been used as a decoration for centuries (Cox, 1957; MacKenzie, 2008a), and these shells, especially being brightly-colored, have enhanced the appearance of food presentations on restaurant serving plates (Fig. 3a, b).

Adamkewicz and Castagna (1988) found that a single gene controls the presence or absence of color in the scallop's shell. One or more additional

¹Castagna, M. Biologist, Virginia Institute of Marine Science, Wachapreague, VA, Personal commun., 1985.

²Gaines, W. Shellfish constable, Edgartown, Mass., Personal commun., 2008.

³Rivara, G. Biologist, Cornell University Extension, Southold, N.Y. Personal commun., 2004.

⁴Zatila, J. Official, F. M. Flower Company, Bayville, N.Y. Personal commun., 2006.

⁵Morrison, A. Biologist, Prince Edward Island Department of Fisheries, Agriculture, and Rural Development, Charlottetown, Canada. Personal commun., 2009.



Figure 1.—Crewman of private culturist harvesting 10-tier lantern nets that hold bay scallops. The lantern nets are suspended from long-lines in Nasketucket Bay, Mass., May, 2009. Note: All photographs by C. L. MacKenzie, Jr.



Figure 2.—Brightly-colored bay scallops after being taken from lantern nets and before being cleaned of fouling organisms for marketing, Nasketucket Bay, Mass.

genes determine the distribution of overlying pigments and the background color of the shell that may be orange, yellow, or white with orange; yellow is dominant over white.

Thus far, one company in Massachusetts, one in New Brunswick, and another on Prince Edward Island have cultured the scallops with economic success. The others abandoned it because profits were too small (The gear used is expensive and too few scallops were produced), or else they have continued on a pilot scale. Restaurants have cooked and served the entire meats (adductor muscles and rims) of the scallops rather than only the muscles. The meats have been sautéed, grilled, or steamed and served in their shells.

United States Production

The Massachusetts company, Taylor Cultured Seafood⁶ in the town of Fairhaven, raises bay scallops and oysters in Nasketucket Bay, an arm of Buzzards Bay on its north side. Chew (1993) briefly described its bay scallop

⁶Mention of the names of commercial firms does not imply endorsement by the National Marine Fisheries Service, NOAA.



Figure 3a.—A restaurant's evening serving of 5 bay scallops, 5 blue mussels, *Mytilus edulis*, 5 shrimp, lobster, and greens with sauces. The brightly-colored bay scallop shells enhance the presentations of the restaurant servings.



Figure 3b.—A restaurant's luncheon serving of 3 bay scallops, 3 blue mussels, and 3 shrimp with sauces.

culture operations. Currently each June, the company obtains about 6 million 1–3 mm seed bay scallops from a hatchery located in Maine. The seed are grown to a height of 5 mm (0.2 in) in flupsies (upwellers) and are then transferred to fine-meshed nets. As growth progresses, the seed are transferred to lantern nets that have coarser netting that allows for more water circulation. Water depth at the lease site where the scallops are grown is as much as 9 m (30 ft). Scallop mortality is at least 50% during their first 3 months; some mortality

continues during all months, but is least in the fall.

From several to 12 months later, the survivors are harvested at a shell height of 60–70 mm (2.5–2.75 in), or about full size (Fig. 4, 5, 6). The company harvests both the scallops and the oysters on market demand every few days year-round. As many as 2 million scallops (4,000–5,000 bushels) are marketed each year. Production has been limited by market demand.

The scallops are sold to a wholesaler who distributes them for about \$0.40 each to restaurants. Properly chilled, the scallops have a shelf life of about one week. Restaurants serve from 3 to 6 scallops with the shells on a plate, some-



Figure 4.—(above) Bay scallops receive good water circulation inside the tiers of large-mesh lantern nets, Nasketucket Bay, Massachusetts.



Figure 5.—(above right) Live bay scallops and the shells of dead scallops in the bottom tier of a lantern net, Nasketucket Bay, Mass.



Figure 6.—(right) A crew emptying bay scallops, destined for market, from a lantern net into tubs. The lantern net holds about a bushel of market-sized scallops, Nasketucket Bay, Mass.

times by themselves with sauces such as liquid corn, but commonly with blue mussels, *Mytilus edulis*, and shrimp and also some lobster, with tomato sauces in Italian restaurants and with various types of sauces and also greens in others. The scallops acquire the flavor of the sauces, and if a diner wants to savor the flavor of the scallop meats it is best to consume them steamed. So prepared, the flavor is similar to that of steamed softshell clams, *Mya arenaria*. Restaurants in southeastern Massachusetts that serve the scallops have been selling about 100 dishes/week but, when busiest, some have been selling as many as 25/day.

Canadian Production

The New Brunswick company, Etang Ruisseau Bar Ltd.⁶ in Shippegan, operates in much the same manner as Taylor Cultured Seafood, but few bay scallops survive the Canadian winters. The company produces seed oysters and bay scallops in its own hatchery. The seed are grown in lantern nets in Baie St. Simon in northeastern New Brunswick.

The scallops are harvested when their heights are 55–65 mm (2.2–2.6 in), beginning on 1 Nov. (4.5 months after the larvae have settled and begin to grow) and ending by mid January. In Canada, the peak demand for them is for meals at home on Christmas Eve and New Year's Eve. They are prepared by steaming them whole in their shells. After mid January, about 10% of the scallops die from the cold each week. Few remain alive by the following spring. The annual quantity of bay scallops the company produces is unknown, but it is smaller than Taylor's in Massachusetts.

A company selling shellfish under the names, Atlantic Mussel Products⁶, and Prince Edward Island Mussel King⁶, in Morell, P.E.I., has produced bay scallops in similar quantities to Etang Ruisseau Bar Ltd. in the years of its highest production. The seed are obtained from Etang Ruisseau Bar Ltd. at a size of 2–3 mm in mid June. The company has had problems producing the scallops every year because large numbers of tunicates (3 species) may settle and

grow on its plastic holding cages and aluminum racks and form a cover over the nettings. The cover can reduce water flows to such an extent that the scallops cannot grow large enough for commercial sales. In successful years, the company has harvested about 10,000 lbs: 130,000 scallops (13 scallops/lb), equal to 200 bushels. It sells the scallops for \$4.00/lb (\$0.31/scallop). Shipments are made in waterproof boxes that each hold four 10-lb bags of live scallops and 10 lbs of ice; they go to Toronto, Boston, New York, and other markets. The Canadian bay scallops shipped to the United States eventually are received by restaurants and prepared similarly to the Massachusetts scallops.

Some cultured bay scallops have spawned and produced natural (wild) populations in Nova Scotia and Prince Edward Island. Their survival has been extremely low in the coldest winters, and thus their quantities are small. The natural scallops apparently were eliminated by a recent cold winter on Prince Edward Island. The scallops have

survived in Merigomish Harbor, Nova Scotia, and in years of good setting enough have survived in subsequent warm winters to provide a commercial crop on a 5-acre lease. During September and November, the lease-holder has gathered at least 300–400 scallops/day by hand as he waded in waters at low tide. The scallops have been shipped live in chilled coolers to the Halifax Farmers' Market. Its retailers sell them to restaurants and home-makers by the pound: 12 to 20 whole scallops/pound. The scallops are steamed similarly to blue mussels and their entire meats are consumed (Bagnall⁷, Docker⁸).

Overview

In Massachusetts, a positive marketing feature of this bay scallop product is its availability to restaurants year-round, including during July–August, this being the time of peak numbers of tourists desiring meals of seafoods. The sales of the Canadian bay scallops in November–December miss this summer period of high consumer demand. The marketing months of the Canadian bay scallops are about the same as those when most northern bay scallops are harvested from beds of naturally-occurring bay scallops from New York–Massachusetts. The scallops, harvested for only their adductor muscles, are sold mostly in fish and supermarkets, usually for home meals rather than for restaurant meals.

⁷Bagnall, A. G. Supervisor of Extension Service, Nova Scotia Fisheries and Aquaculture, Halifax, Canada. Personal commun., 2009.

⁸Docker, P. Shellfish Leaseholder, Merigomish, Nova Scotia, Canada. Personal commun., 2009.

Dishes of cooked whole meats and attractive shells of bay scallops are a new food product that has not been mentioned in recent articles about the scallop fishery (MacKenzie, 2008b). If more people go to restaurants seeking the dish, this type of hatchery-growout culture of northern bay scallops undoubtedly will expand.

Acknowledgments

Leslie-Anne Davidson, Canadian Department of Fisheries and Oceans, Gulf Region, Moncton, New Brunswick, Canada; David Whittaker (retired), Massachusetts Division of Marine Fisheries, New Bedford, Massachusetts; Rodman Taylor and Patricia Taylor, Taylor Cultured Seafood; André Mallet, Etang Ruisseau Bar Ltd.; and Bruce Smith, Atlantic Mussel Products and Prince Edward Island Mussel King, contributed information for this paper.

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