Penobscot Bay Scallop Tagging Report

Maine Department of Marine Resources

Updated

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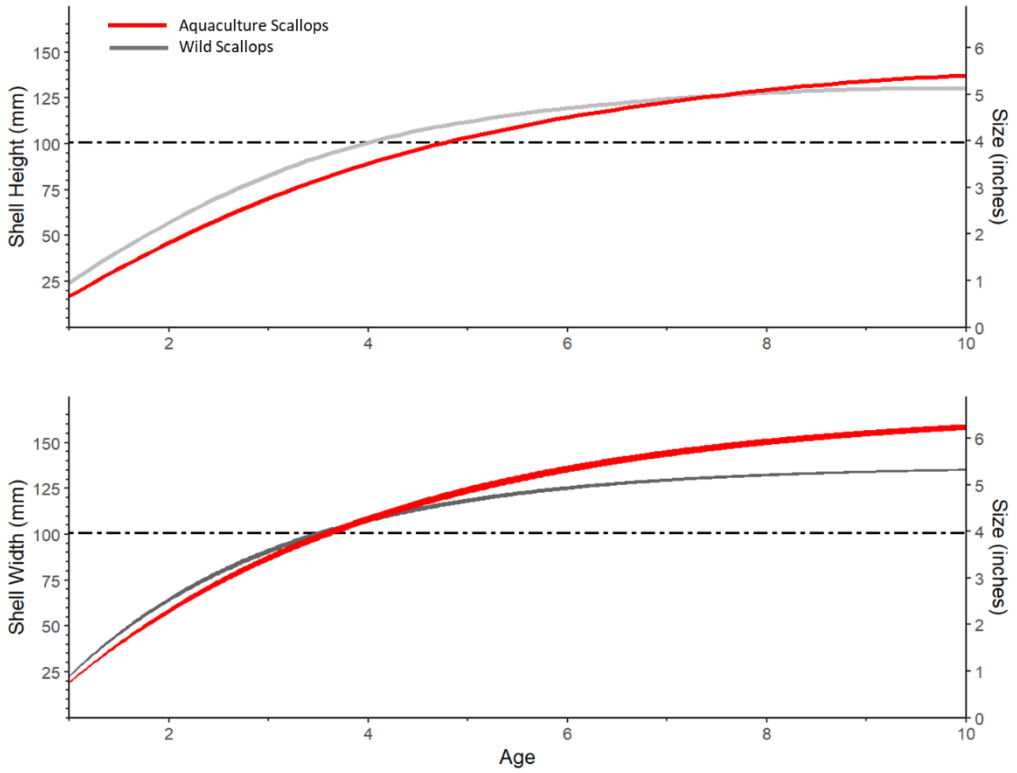
Scientific article: *In progress*

Summary

Despite previous work describing the growth of scallops throughout Maine there are still unknowns regarding the current growth of scallops in each unique bay. In 2020 the Maine DMR and Hurricane Island Center for Science and Leadership tagged and released 802 measured scallops into the lower Penobscot Bay scallop rotational area to improve our understanding of growth for this region. Harvesters returned 101 tagged wild scallops during the 2021-22 scallop season, 75 of which were alive at the time of recapture. All of these scallops were recaptured within one mile of the original release site. Growth estimates from this study were approximately 10% lower than previous studies with a slightly lower predicted maximum size. Growth was also monitored at the Hurricane Island Aquaculture site for similar sized scallops. The shell height had similar growth rates between the wild scallops and aquaculture ones, but the shell width growth was faster in the scallops held at the aquaculture site.



Summary Plot Estimated growth results for wild (grey) and aquaculture scallops (red) from the Penobscot Bay tagging data for scallops tagged in 2020. The top graph is the estimated growth of the shell height, and the bottom is the shell width. The dashed line indicates the legal shell size for wild caught scallops in Maine.

Background:

Scallops grow by continuously adding new minerals to the outer edge of their shell (Chute et al 2012). The rate of this growth is dependent upon many factors, the primary factors are scallop size, water temperature, food availability and general habitat (Hart & Chute 2009). The change in growth rates for individuals can be observed by growth rings captured in the shell which can be used to determine age and annual growth by experts able to distinguish between the annual rings and false rings (Chute et al 2012).

The growth of juvenile scallops is relatively rapid, growing on average one inch per year until approximately three years old when they start to shift their energy towards reproduction (Hart and Chute 2009; Stevenson and Dickie 1954; Truesdell 2014). As scallops approach the theoretical maximum size for the given conditions the shell growth slows. This change in growth can be demonstrated mathematically with the von Bertalanffy growth equations where the parameter L_∞ represents this theoretical maximum size and the Brody growth coefficient (K) represents the rate at which the animals reach the maximum size (Von Bertalanffy 1938).

There have been many studies which have estimated growth of Atlantic Sea scallops across their range, including around the Gulf of Maine (Fig. 1; Schick et al. 1988, Truesdell 2014, Hodgden et al 2020). In general, growth rates are faster in warmer locations (50-60°F) with higher food availability (Stewart and Arnold 1994). Scallops in deeper or more northerly waters tend to have slower growth but reach larger sizes. The maximum recorded size for the sea scallop is approximately 9 inches with a maximum age of over 20 years.

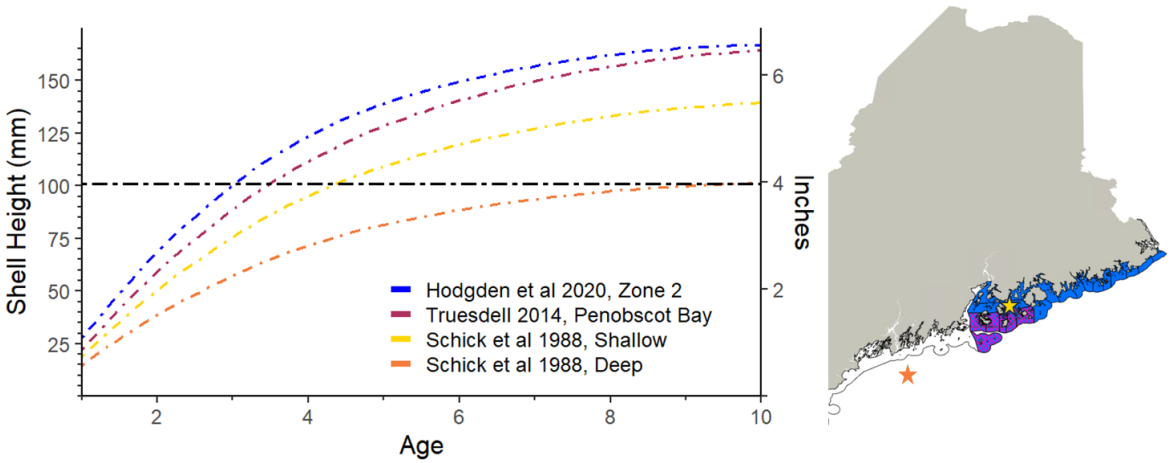


Figure 1. Estimated shell size at age from von Bertalanffy parameters provided by previous studies along the Maine Coast. The colors of each line match the approximate locations shaded on the map. The solid black line represents the minimum legal harvestable size.

Given the dynamic conditions in coastal Maine, scallops could move short distances and experience different environmental conditions controlling their growth rates, particularly if they move to different depths. Scallops are known to be mobile animals, larger individuals are capable of swimming to avoid predators, but smaller scallops are more active swimmers. Scallops can move with the tides, but the range and distance of these movements is still a question. By tagging and recapturing scallops, area specific growth rates can be calculated and document potential movement.

Methods:

In June 2020, 802 scallops between 3-3.5 inches were caught with a commercial scallop dredge from a known scallop bed in 50-70 ft around Leadbetter Island in the Lower Penobscot Bay rotational area. The scallops were transferred to Hurricane Island to be measured and tagged with an orange disk tag attached to the left ear of the scallop shell (Fig 2.) While the scallops were not being processed, they were kept in cages off the Hurricane Island dock. They were returned to within 1 nm of their capture location within 8 hours, the exact location of each release recorded.

Figure 2. Images of tagged scallops with the red line showing where shell height measurements are taken and the orange line showing shell width. Photo credit: Hurricane Island; check here for more information https://www.hurricaneisland.net/research-blog/2020/6/25/scallop-tagging-study

The following day 200 wild set aquaculture scallops grown by the Hurricane Island Center for Science and Leadership, were tagged, measured and returned to lantern nets and hung on the Hurricane Island aquaculture site. These scallops were measured again in July 2021 and June 2022.

When the Lower Penobscot Bay rotational area was opened, harvesters were asked to record date, location and cause of mortality (clapper or harvested), and send both halves of the shell with the tag still attached to the DMR office.

Results:

During the 2021-2022 season harvesters returned 101 tagged wild scallops shell, 75 of which were alive at the time of recapture. Three additional live scallops were returned during the 2024-2025 season (Table 1). All scallops were recaptured within one mile of the original release site. Once returned, the scallop shells are measured, catch dates recorded and catch locations mapped (Fig. 3).

Table 1. Observed growth of the three scallops returned during the 2024-2025 fishing season. The last column is the estimated growth using the Truesdell 2014 growth study data.

Size At Tagging (inches)	Recapture Size (inches) after 4 years	Total Growth (inches)	Truesdell 2014 Predicted Growth
4.69	5.43	0.74	1.7
4.27	4.72	0.45	1.6
4.51	5.28	0.77	1.7

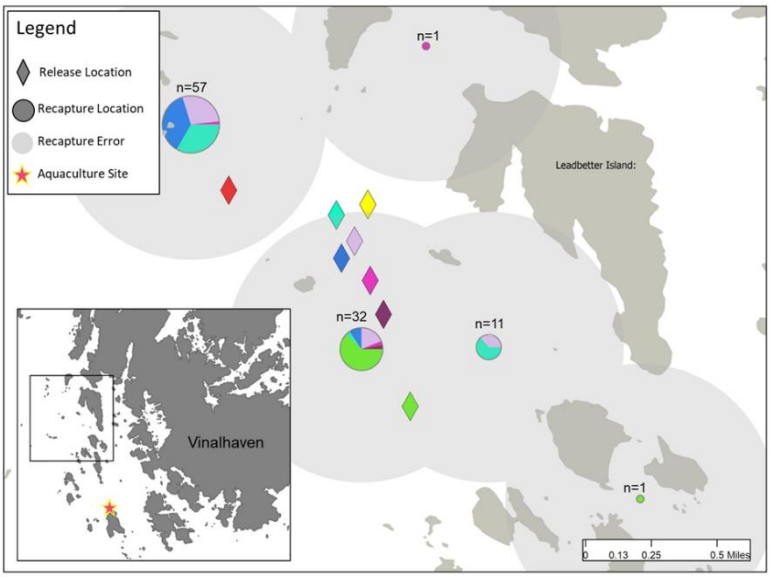


Figure 3. Approximate locations of release (diamonds) and recapture sites (circles) for the tagged scallops in this study. The color of the circle matches the release site for Individual scallops, and the size is representative of how many scallops were recorded at each recapture site, grey circles indicate the potential distance covered by each tow catching tagged scallops.

Growth rates and von Bertalanffy growth parameters were estimated for recaptured scallops as well as the aquaculture raised scallops. This analysis revealed that wild and aquaculture scallops have a similar growth rate for shell height, but aquaculture scallops have a higher growth rate for width and a larger maximum size. Generally, a 3-inch-wide scallop in aquaculture gear is expected to grow nearly 1 inch in a year while the width of the wild scallop in this area increased by approximately 0.9 inches.

Comparing growth rates of the wild scallops in this study to growth rates of wild scallops from other recent studies (Penobscot Bay (Truesdell 2014), greater zone 2 area (Hodgdon et al 2020)), it was determined that the scallops in the western Penobscot Bay area have a slower growth rate than was previously indicated (Table 2). The scallops recovered in the 2020 tagging study revealed a projected yearly growth near legal size was 6-8% lower than was predicted in the Truesdell study performed in 2014, and 8-10% lower than was predicted by the Hodgden study in 2020. This also leads to a slightly lower predicted maximum size. The growth estimates from this study were very close to the shallow water estimates from scallops collected near Jericho Bay by Schick et al (1988).

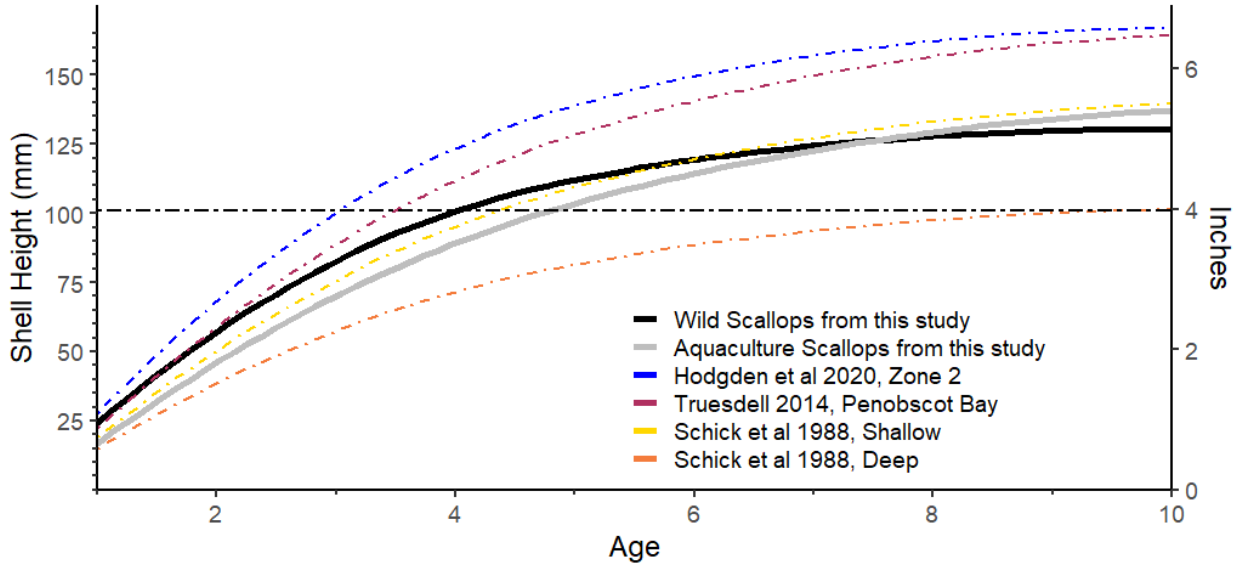


Figure 4. Estimates of shell length at age from von Bertalanffy parameters provided by this study for wild scallops in black and the aquaculture scallops in grey compared to previous studies along the Maine Coast.

Table 2: Estimated projected shell height (inches) based on scallop size at start for 3 different tagging studies examining scallops in Western Penobscot Bay.

	Projected size after 1 year			Percent Difference	
Size at start (inches)	Pen Bay (Tagging)	Pen Bay (Truesdell)	Hodgdon (Zone 2)	vs Truesdell	vs Hodgdon
3	3.76	4	4.17	6.00%	9.83%
3.5	4.1	4.38	4.53	6.39%	9.49%
4	4.4	4.73	4.85	6.98%	9.28%
4.5	4.74	5.11	5.21	7.24%	9.02%
5	5.08	5.49	5.56	7.47%	8.63%

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