The Most Beautiful Oyster

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Even among noted admirers and researchers the appearance of the humble oyster has not always attracted praise: *"An oyster,. . .the exterior is not persuasive"* and *"such uninviting, and even repulsive things"* (Beecher 1862); "*scaly, drably colored, encrusted, roughly shaped... among the least aesthetically appealing in the Class Bivalvia"* (Carriker 1996). Despite its homely countenance, the exterior appearance of the sometimes maligned oyster is increasingly the subject of attention.

It has long been a truism that we *eat first with our eyes* and that the overall appearance of an oyster, including its shape, can be important to commercial success (Brake *et al*. 2003). Consumers are attracted by "good looking" oysters (Ruello 2002) and with cultivation has come the opportunity to manipulate the appearance of oysters (Carriker 1996). The size, shape and external appearance of an oyster can be altered through cultchless production or modified handling practices. Further, the advent of oyster breeding programs has demonstrated that shape is in part genetically determined (Ward *et al*. 2005), which has led to shape characteristics being included among traits for selective breeding (Kube *et al*. 2011).

While consumers are likely to be the ultimate arbiters of oyster "beauty" they will be influenced by what farmers choose to produce and what oyster processors and restaurateurs elect to sell. Although farmers clearly have the final consumer in mind, consumer preference is not the sole driver and other factors are considered. Characteristics of shape can influence stock handling and management. For example, thin oysters can "peg" or catch in the mesh of trays and those with hooked umbos can be difficult to mechanically grade and open. Convexity of valves is an issue. The shape of the left valve can affect packing and presentation for market and some prefer flatter oysters in this regard. Increased convexity in the right valve often produces an oyster with a plump appearance when presented in the half shell.

Aesthetics are likely to be species specific, but for the cupped oysters, such as *Crassostrea* spp., it has been suggested that farmed oysters should have a "tear drop" shape (Heath and Wilson 1999). Simple indices have been developed to describe shape. Galtsoff (1964, adapted from Crozier 1914) used a ratio of the sum of the oyster's height (APM) and width (sometimes known as depth or thickness) divided by its length (DVM). For Irish Pacific oysters, a ratio of 3 on this scale is considered average with scores above and below this level considered poor and good, respectively (BIM 1996). In two southern states of Australia (Tasmania and South Australia), the Pacific oyster breeding program has highlighted the importance of shape as a characteristic for breeding (Ward *et al*. 2005) and is currently targeting a ratio of 3:2:1 (height:length:width) as a desirable standard for production (Kube *et al*. 2011).

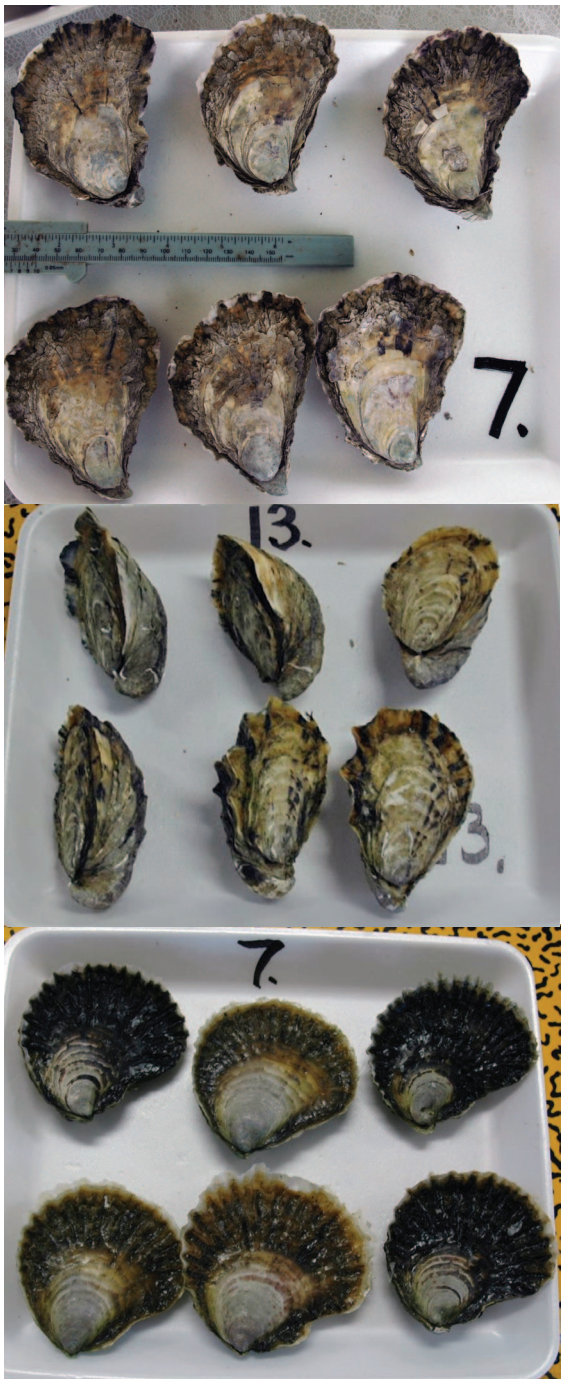

FIGURE 1. *Examples of winning oyster entries: (top) Sydney rock oysters* Saccostrea glomerata, *(middle) Pacific oysters* Crassostrea gigas, *and (bottom) flat oysters* Ostrea angasi.

In New South Wales (NSW), Australia, three oyster species are produced commercially; the most important is the Sydney rock oyster *Saccostrea glomerata*, followed by the Pacific oyster *Crassostrea gigas*, and the flat oyster *Ostrea angasi* (O'Connor and Dove 2009). A breeding program for the Sydney rock oyster has been active since 1990 (Nell 2003) and NSW farmers can access stocks from this program and those of the Australian Seafood Industries' Pacific oyster breeding program in Tasmania. Both programs actively use shape as criteria for stock selection (Kube *et al*. 2014).

To gain greater insight into those oyster characteristics thought desirable by oyster farmers in NSW, an annual oyster beauty

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competition was organized where entries from farmers are judged by their peers and the outcomes considered for ongoing oyster breeding programs.

Competition Methods

Beginning in 2006 a "Most Beautiful Oyster Competition" has been held in conjunction with annual NSW oyster industry field days. Generally, two gatherings are held within days of each other on the mid-north and south coasts of NSW. Each gathering routinely attracts in excess of 100 industry participants from an industry with some 330 permit holders.

Interested farmers are invited to submit six unopened oysters for display in any given class. Classes initially included Sydney rock oyster stick-cultivated, Sydney rock oyster single seed (cultchless cultivation), Pacific oysters and flat oysters. The inclusion of some classes for judging at each field day was constrained by species cultivation range. Prizes were awarded for Sydney rock oysters at all field days, but submission of Pacific oysters was initially limited to northern gatherings because cultivation of this species was prohibited until 2008 in all southern estuaries (O'Connor and Dove 2009). In contrast, flat oyster submissions were largely limited to south coast field days because there is currently little cultivation of the species in central or northern regions of NSW.

No restrictions were placed on size or age of oysters submitted within any given class. Application of cosmetics was strictly banned and no special presentation tools, such as soft lighting, silver platters or garnishes were permitted. Oysters were delivered to officials on the morning of the competition, who numbered submissions and displayed oysters, unopened, within classes for the duration of the field day. On each field day participants were allowed one vote in each class. Participants were given no information on the source (origin or producer) of the oysters but were permitted to handle oysters before votes were recorded on official ballots and placed in a sealed voting box. At the end of each field day, votes were tallied and awards presented to those entries judged by oyster industry participants to be the "most beautiful."

Before display, each oyster in each entry was photographed, weighed (±0.1 g) and measured (APM, DVM and width ± 0.5 mm) and the results recorded for later analysis.

Competition Results and Discussion

Over a four-year period, 64 Sydney rock oysters, 32 Pacific oysters and 8 flat oysters were submitted and a total of 472, 226 event participants and 81 oyster industry participants voted in each class. A synopsis of the results is presented in Table 1. It is evident that NSW oyster farmers showed marked preferences in both the oysters they submitted as being representative of their best and in their choice of overall champions within each class. The measured characteristics (weight, size and shape) of the winning oysters differed among species.

Sydney rock oysters

The overwhelming majority of Sydney rock oyster entries were from cultchless production systems, either hatchery produced spat, or wild-caught seed scraped from collectors at a small size (<10 mm). Only three "stick" grown entries were submitted and, as a result, data for these oysters were not analysed and this category was ultimately excluded from the two 2009 field days. All but 11 of the 64 Sydney rock oyster entries were heavier "plate grade" oysters (>60 g) in preference to the smaller, more commonly produced "bottle" (50 g) and "bistro" (55 g) grade oysters that constitute over 75 percent of NSW oyster production. None of the lighter entries received a prize. Indeed, the lowest mean weight of a prize winning entry was 78 g per oyster and the average weight for prize winning oysters was over 90 g, approximately 17 g heavier than the mean weight of all the Sydney rock oyster entries submitted. Although heavier, the mean size of the winning entries differed little from the overall mean size of all entries.

The uniformity of the six oysters submitted as an entry was thought to be a factor that might contribute to their perceived "beauty". However this was not clearly evident because the mean CV for oyster weight and height for winning entries was very similar to the mean for all entries. The mean coefficient of variation (CV) for oyster weight (11 percent) and height (4 percent) among the winning entries differed little from that of the mean for all entries (11 and 5 percent, respectively) and no significant correlation was observed between the CVs for individual entry weights and votes received (r = 0.44) or sample heights and votes received (r = -0.29).

To date, there has been no attempt to describe the ideal

TABLE 5. A synopsis of data collected for Sydney rock, Pacific and flat oysters submitted for "The Most Beautiful Oyster" competition, 2006 - 2009.

	N	*Mean weight (g) (APM)*	*Mean height (mm) (DVM)*	*Mean length (mm)*	*Mean width (mm)*	*Ratio (H:L:W)*
Sydney rock oysters (all)	64	73.2	88.3	65.4	23.5	3:2.22:0.80
Sydney rock oysters (winners)	8	90.9	85.1	64.9	26.3	3:2.29:0.93
Pacific oysters (all)*	32	123.4	101.1	63.3	35.9	3:1.87:1.06
Pacific oysters (winners)	6	97.2	89.9	55.1	32.4	3:1.84:1.03
Flat (all)	8	97.9	92.0	87.5	25.8	3:2.85:0.83

** Excludes weight and measurement data from three entries in which individual oyster weights exceeded 250 g. These submissions were not among the winners.*

dimensions for Sydney rock oysters, but it was clear that preferences exist and that NSW farmers are looking for characteristics slightly different from those selected as the optimum for Pacific oysters. The average ratio of height:length:width for Sydney rock oyster entries was 3: 2.22: 0.80, while the average for winning entries was 3: 2.29: 0.93. Winning entries tended to be longer and wider than the average oyster submitted.

Farmers were clear in their preferences for Sydney rock oysters, with the winning entries attracting approximately 55 percent of the total vote within that class. Indeed this is likely to be an underestimate of their preference because there were instances where it was clear that farmers were voting for their own entry. Assuming each farmer did this and one vote was deducted from the total of each entry's score, the proportion of the total vote received by the winners exceeded 65 percent.

Pacific oysters

The culture of Pacific oysters in NSW is unique within an Australian context in several respects. Like Tasmania and South Australia, the majority of oysters cultivated are hatchery produced, but a major, although unquantified, proportion of NSW Pacific oyster production arises from wild catch from a single estuary, Port Stephens. This is the only estuary where wild Pacific oysters can be collected legally because this is the only location where government approval to culture diploid Pacific oysters has been granted. All other Pacific oysters cultured within the state are required to be triploid and eight estuaries in NSW have the appropriate government approvals for this. Accordingly the vast majority (>80 percent) of entries within this class were hatchery produced, triploid oysters.

Perhaps reflective of the comparatively high growth rates of Pacific oysters in NSW and the inherent growth advantages of triploid stock, all but four of the 32 entries were large oysters (> 75 g each). However, unlike Sydney rock oysters, the weight and dimensions of the winning Pacific oyster entries were significantly less than the average for all submissions. This could reflect a NSW industry accustomed to production of the comparatively smaller Sydney rock oysters and one in which the major market is for oysters in the half shell.

Three of the 32 entries consisted of oysters with individual weights exceeding 250 g, beyond the measurement capacity of the scales provided. These entries were frequently regarded as a novelty and were not among the winners. Their dimensions were included to calculate a ratio to be indicative of shape, but they were not included in the overall weight and measurement averages shown in Table 1.

There was little difference between the shape of the winning Pacific oysters (3: 1.84: 1.03) and the average for all submissions (3: 1.87: 1.05). This average is close to the southern Australian Pacific oyster producers target ratio of 3:2:1 (Kube *et al*. 2011) and well within the range considered good (< 3) for Irish Pacific oysters (BIM 1996). Indeed every Pacific oyster entry within the competition had a "good" score of less than 3.

The winning Pacific oyster entries attracted approximately 38 percent of the total vote within this class. This is less than observed with Sydney rock oysters and could reflect a number of factors. First, Pacific oysters are comparatively new to culture in NSW and are only permitted to be cultured in five of the state's 32 oyster-producing estuaries when these data were collected. Many of farmers who voted in the Pacific oyster category were not experienced in Pacific oyster culture and may have been less certain about their preferences. More importantly however, the numerical dominance of triploid oyster entries from Australia's single hatchery producer of triploid Pacific oysters is likely to have led to greater inherent uniformity in the stock, making choice more difficult. This may also explain why the general shape of all oysters submitted differed little from the overall winners.

Flat oysters

As the name suggests flat oysters have a markedly different shape to the two cupped oysters (Sydney rock oysters and Pacific oysters) and this was reflected clearly in their overall dimensions (3: 2.85: 0.83). Although there were too few submissions to warrant great consideration, those entered were generally representative of oysters currently marketed. In most instances, oysters were approximately round in shape, with a width similar to that measured for Sydney rock oysters. Often the oysters submitted had a "rumbled" appearance with recent shell growth knocked off due to handling or movement in culture. However, the winner of this class (Fig. 1) at the south coast field day (Batemans Bay, NSW, 2009) did not have this appearance and was the most popular exhibit at any show in any class, attracting over 82 percent of the total vote. It is also worth noting that this entry was also the smallest ever submitted in the class (84 mm mean shell height).

Do as I Do: Implications for the Sydney Rock Oyster Breeding Program

Is it a case of "do as I do, not do as I say"? Despite showing a clear preference for large cultchless plate-grade Sydney rock oysters, NSW farmers most commonly sell smaller, often stick-grown oysters (O'Connor and Dove 2009). There are commercial drivers that influence sale size, such as meat condition, variable growth rates and disease. However, a premium price is paid for larger grades of oysters. Regardless, many farmers complain that selectively bred Sydney rock oysters are too flat and in a recent survey 44 percent of respondents listed shape as their greatest concern with current breeding lines. This has undoubtedly been exacerbated by some growing practices and the age of selectively bred oysters at harvest, but it has led to changes in selection processes and has forced shape to be included as a characteristic in ongoing selective breeding programs.

This trait has always been carefully considered and monitored in selectively bred oysters that may be cultured under different methods and conditions compared to commercial stocks. The inclusion of additional traits within the breeding program is likely to detract from the rate of progress with other factors and thus there should be an economic incentive for its inclusion. Unfortunately, there is limited evidence for this. Australian surveys have shown that oyster appearance (presentation, shape and size) is a factor that explains only 4.4 percent of the variance associated with consumer oyster attribute scores and these scores are not species specific (Kow *et al*. 2008). Given that appearance is arguably more variable in Sydney rock oysters than Pacific oysters, it may well be more important to consumers of this species. At this time, shape in Sydney rock oyster family lines is being monitored and decisions

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regarding its inclusion as a trait for selection are in abeyance pending the determination of heritability estimates and the economic value of shape.

Acknowledgments

The authors acknowledge the assistance and support of NSW oyster industry. Special thanks to NSW Farmers Association, Rachel King and Ian Lyall for their ongoing support for the competition. Prizes for award winners were provided by NSW Department of Primary Industries and the Select Oyster Company. Thanks to Drs. Mark Booth, Geoff Allan and Peter Kube for valuable editorial comments.

Notes

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