

MINUTES OF THE WCC-99 MEETING,  
DOUBLETREE HOTEL, NEW ORLEANS, LOUISIANA

APRIL 12<sup>TH</sup> 2003

**Chris Langdon** opened meeting with introduction of Sandra Ristow, new WCC-99 coordinator, and general comments about meeting agenda and utility of the WCC-99 as a forum for discussion of molluscan breeding efforts in the United States and elsewhere.

**Mark Camara** (VIMS) opened the discussion with a presentation on East coast research at VIMS. Mark described East coast breeding efforts to date at VIMS as “faith-based” selection that neglected to estimate heritabilities, GxE interactions or genetic correlations for lines produced to date. He outlined a new (traditional) approach for developing a family-based program for breeding Eastern oyster lines with disease resistance to Dermo and MSX that will be the focus of VIMS breeding efforts in the future. Mark also stressed that non-additive effects in DEBYS and CROSSBREEDS may be important as he noted that outbred oysters from crosses of inbred lines lost disease resistance. Traditional family-based selection allows heritability estimates, genetic correlations and GxE interactions to be calculated and provide means for comparing progress with other breeding efforts. Also, working with pedigreed lines allows other researchers to work on the same biological material. Mark also outlined the new VIMS breeding facility that will enable a family-based approach to oyster breeding in the near future (2003). The breeding program will be patterned after MBP at Oregon State University with 50 families per year generated in the hatchery and growout accomplished in individual, replicated grow bags. The primary breeding goal will be dual resistance to MSX and Dermo. Specific lines to be crossed to produce initial cohort of families will focus on existing DEBY, CROSSBREED, Mobjack and Louisiana stocks.

Mark provided additional information on *Mercenaria mercenaria* breeding efforts in Virginia. In this case, a walk back breeding approach was described whereby offspring from pair-mated families generated in the hatchery are pooled and placed into common plots. At harvest, individual clams are ranked by size, genotyped utilizing microsatellite markers and assigned to families. Comments to this approach related mainly to the expense of genotyping large numbers of clams. Discussion included comments on use of maximum likelihood and Monte-Carlo methods for measuring relatedness between clams. Also, mention was made of the need to engage industry more fully with the clam breeding program, and breeding in the future for traits other than size at age (shell color, flavor, etc.).

The second talk was presented by **Kim Reece** (VIMS). She discussed the status of the CROSSBREED program with respect to resistance to Dermo and MSX as selection goals. The program produced oysters with initial resistance to both diseases but crossing survivors resulted in apparent inbreeding depression. Results indicated that select lines showed better Dermo resistance in most localities. A second set of lines based on oysters from Delaware Bay (started in 1987 and referred to as DEBY's) that were spawned at VIMS showed similar results in that the F2 survived better than did the F1. Dermo

resistance was better than that of local oysters, resistance to MSX was better than that of Louisiana controls lines and overall survival was better than either local controls or the Louisiana controls. The bottom line is that growers are harvesting 40-50% of the selected oysters grown commercially.

A general discussion of current breeding efforts in Eastern oysters was led by **Mark Camara**. Discussion focused on what oysters to utilize in native oyster reef restoration efforts. The problem identified was that if local oysters recruit to reef structures they generally do not survive due to disease prevalence. There is the possible use of selected lines to populate reefs, which brings up the question of interaction of selected oysters with wild populations on a genetic basis. Effects of mating select lines with wild oysters and impacts to natural diversity were addressed. For example, the Mobjack line, if used for restoration, has shown better resistance to MSX, but poorer resistance to Dermo than local Mobjack Bay oysters. Discussion of genetic markers used for line development followed. Noted was the possible contamination of CROSSBREED's with Gulf oysters. In addition, it was pointed out on the basis of markers that DEBY's are quite inbred as are the CROSSBREED's, however the CROSSBREED's appear less inbred having greater allelic diversity than DEBY's. Ongoing research discussed utilizing DEBY's in reef restoration in Great Wicomico River system. The question being addressed concerns the detection of a recruitment signature with DEBY genes in oysters recruiting to the reef. Also discussed was the dichotomy in goals between oyster restoration and aquaculture.

The next discussion on other East coast genetics and breeding work was led by **Ximing Guo** of Rutgers University. Ximing discussed ongoing genetics and breeding projects at Rutgers. These include among others:

- Breeding and evaluation of NE oysters stocks
- Aueuploidy and triploidy in oysters
- Triploid and tetraploid development in Eastern oysters
- Triploid and tetraploid hard clams
- Expression and analysis of host response
- Genome and gene mapping in Eastern oysters
- Genomic mapping of Pacific oysters (AFLP map)

Ximing focused the discussion on evaluation of two Eastern oyster selected lines that were placed into growout in a variety of locations in southern New England. These included:

- NEH - Rutgers lines selected for MSX resistance since 1964 and Dermo since 1998
- FHM – FM Flowers line selected for JOD resistance since 1990
- HYB – a hybrid cross between NEH and FHM
- NE4 – a line of selected oysters from Maine
- NE5 – a Massachusetts stock

Results of growout trials in Connecticut and Cape Cod, MA showed promising results for the HYB line, the NE4 and NE5 lines did poorly.

Tetraploid Eastern oyster were also discussed as Ximing has produced second-generation 4N oysters (several thousand) in 2002. One result of work was a relatively high (2%) proportion of oysters observed in mated triploids. There was additional

discussion of AFLP linkage mapping for Eastern oysters, which is still incomplete. Twenty-three markers at present showing segregation distortion and 17 showing homozygote deficiency. Ximing mentioned his interest in identifying markers linked to MSX resistance and possible use for marker-assisted selection (MAS) in the future.

Kim Reece presented for **Pat Gaffney** in a talk, entitled “ Microsatellite and SNP Markers for the Eastern Oyster”, and Pat’s experiences using these different types of markers. Of particular interest is use of markers for identifying and monitoring of genetic impacts on wild bivalve stocks due to aquaculture and ongoing restoration efforts with wild populations. Kim discussed sourcing microsatellite libraries and focused on issues relating to developing microsats for Eastern oysters. Prevalence of null alleles was noted and partially alleviated by shifting primer binding sites. This approach, however, is expensive and time consuming. Pat also found about 4.5% polyporphisms in flanking regions that is contrary to genetic dogma. Polymorphisms don’t bind and amplify which is a problem. In summary, microsatellite markers are important for linkage mapping, genetic monitoring for restoration purposes, population genetics studies, tracking of family lines (pedigreeing) and diversity estimates. Single nucleotide polymorphisms (SNP’s) have appeal in genetic studies as well because of their abundance and high variability in mollusks. They enable simple genotyping, they are scorable by various methods, methods are portable between labs and high throughput is possible. Discussion followed within the group over merits of SNP’s versus microsatellite markers and systems in use at various laboratories.

**Paul Rawson** followed with a talk on progress in Maine in developing broodstocks for Eastern oysters. There has not been a great deal of progress due to funding limitations, with the exception of new hatchery facility recently completed at the Darling Marine Center. He discussed local Maine selected lines noting that these lines appear inbred. Paul discussed need to invigorate lines through introduction of genes from other lines and mentioned the Flowers and Haskins lines as candidates. There was a brief discussion of whether native stocks exist in Maine at present and whether these are of any use in a breeding program.

**Jean-Francois Samain** and **Jeanne Moal** followed with a general discussion of the goals and current status of the French MOREST project focused on determining the cause of summer mortality in French *C. gigas* stocks. Web site describing results to date is [www.ifremer.fr/GigasBase/](http://www.ifremer.fr/GigasBase/). Jean-Francois discussed results to date of program and general success of initial breeding efforts. Focus of research has been multidimensional. Temperatures in excess of 19 °C, bacterial infections, oxygen levels, and reproductive condition are implicated in oyster mortalities. MOREST is a large program with strong interest in collaborating with West coast US research effort in the same areas.

Guest speaker, **Achim Janke** discussed general research in oyster breeding and algal culture ongoing at the Cawthron Institute (Nelson, New Zealand).

**Joth Davis** (Taylor Shellfish Farms) initiated reporting on West coast research in genetics and breeding and discussed the current status of WRAC funded crossbreeding

research with Pacific oysters. He gave a short history of the project and results to date. Field trials of hybrid lines grown in an interim field nursery generally maintain their relative rank (yield) when grown out to harvest size (12 months) at one site in Washington State. Joth discussed the problems inherent in large-scale seed testing trials and the need to optimize all aspects of husbandry in order to test large numbers of crosses with adequate replication.

**Chris Langdon** followed with an update on the Molluscan Broodstock Program based at the Hatfield Marine Science Center in Newport, Oregon. Chris pointed out that Pacific oysters selected for yield were averaging 9.4% higher after a generation of selection. Commercial scale experiments were described confirming the superior performance of MBP lines. Chris Langdon's talk was followed by Chris's PhD student, Ford Evans. Ford discussed results of a research project focused on looking at the effect of nursery environment (low versus high food availability) on final yield in Pacific oysters. Interim yields appear influenced by nursery environment whereas final yields were not significantly affected by nursery conditions.

**Sandra Ristow** of Washington State University spoke briefly about the value of WCC and the need to continue in the years ahead. The business meeting followed this introduction with a new Chair (Paul Rawson) and secretary (Kim Reece) appointed. The next WCC meeting was tentatively suggested to occur in Honolulu in conjunction with the WAS convention in March 2004. Following brief discussion, the meeting was adjourned by Chris Langdon.