MEMORANDUM

DATE: September 10, 2002

TO: Division of Shellfish Sanitation Staff

FROM: Robert E. Croonenberghs, PhD, Director
Division of Shellfish Sanitation

SUBJECT: Seawater - Pesticide and Heavy Metal Sampling

Purpose

The purpose of this working memo is to provide a sampling strategy to be used by the field directors while organizing the collection of shellfish for pesticide and heavy metal analysis.

Introduction

When the pesticide and heavy metal sampling program was initially set up in 1974, the Commonwealth was experiencing a high degree of concern about these toxic substances. The Division has been regularly collecting shell oyster samples since that time from designated stations, and since oysters are no longer available in many of the original sampling locations, the number of samples collected has gradually decreased over the years. Nevertheless, this continuous sampling has proven several points:

1. Pesticides have never been a problem in Virginia oysters, except for two instances.
   a. Prior to 1982 Kepone showed up at trace concentrations, ranging from 0.11 to 0.54 ppm. No Kepone has shown up in oyster samples since that time, and as such can be considered as not being a health risk.
   b. Toxaphene showed up in oysters from Nassawadox Creek (1.3 ppm) and in Cherrystone Inlet (2.6 ppm) in the spring of 1977 when a crop duster crashed into one of the creeks. Toxaphene never showed up again in any oyster samples.

2. Considering the evidence in #1 above, we can conclude that general pesticide use does not concentrate in Virginia shellfish to levels of public health concern. This conclusion applies to hard clams as well as oysters, since oysters tend to concentrate pesticides to higher levels than hard clams. Furthermore, we can conclude that short term contamination in localized growing areas is the only likely concern we would have related to the environmental use of pesticides. This then affects our sampling strategy.

3. Heavy metals have never been above action levels in shellfish from Virginia waters except for lead in the Elizabeth River. In 1982 the Elizabeth River was reclassified from restricted toprohibited due to the concentrations of lead in clams there. Hard clams were showing concentrations of 6 ppm. Current EPA guidelines suggest action levels of: 1.5 ppm for children of 2-5 years, 2.1 ppm for pregnant women and 6.3 for other adults. Intensive Division sampling of hard clams in the Elizabeth River in June 1994 indicated concentrations in the main stem and Western Branch to be at 1 ppm. Only the Eastern Branch showed

concentrations of 2 ppm. The scientific literature indicates that lead in molluscan shellfish is decreasing worldwide in the developed countries, and this is attributed to the elimination of tetraethyl lead in gasoline. Urban runoff apparently caused the high lead levels in the Elizabeth River, and those concentrations have dropped significantly.

4. Since lead appears to be the only heavy metal of potential concern in Virginia, and that concern appears to be restricted to urban runoff affected areas, we should incorporate this into our sampling protocol.

5. The last point to make in reference to our data is that it has merit. Concerns about pesticides and heavy metals in shellfish will always exist with the public. As such, it is important to have current data to show that they are not a problem in Virginia.

Discussion

Over 25 years of data collected by the Division have shown that there are two types of concerns with respect to pesticides and heavy metals in shellstock shellfish collected from growing areas in Virginia. Pesticides are not concentrated to a significant degree from our growing waters in general, the only concern is for isolated areas that may be contaminated for short periods of time. Pesticides with long half-lives are no longer used, and the new short-lived pesticides are not bioaccumulating to measurable concentrations in shellfish. The second point is that heavy metals are not a concern in shellfish from Virginia waters, except that lead could accumulate to slightly elevated concentrations in areas of limited tidal flushing that receive a high degree of urban runoff.

Since pesticides and heavy metals are not generally concentrated to a measurable degree, there is no longer a need to track concentrations over time at permanent sampling stations to try to determine trends. There is no measurable trend up or down. Therefore, we can now take samples at varying locations. Indeed, taking samples from different locations over time may provide better assurance of the safety of our shellfish to the public, especially if we sample areas of regional concern, e.g., near sludge application areas, plasticulture areas, etc.

There are probably some areas where we will want to try to maintain relatively permanent sampling stations, since they represent areas with potentially steady sources of input. One such area could be the Elizabeth River, which is probably the most contaminated tributary in Virginia shellfish waters. Another area would be clams from Hampton Roads in general, just to provide an ongoing assurance of safety in that heavily urbanized and heavily harvested area.

Sampling Protocol

1. The field director shall decide the location of sampling stations and the number of samples to be collected. Generally, 3 to 5 stations should be sampled per field office each spring and fall. More may be sampled if special situations arise.

2. Sampling locations should be chosen from active harvest areas, and the locations should be changed routinely so that a widespread picture develops. The one exception would be the claming grounds in Hampton Roads.

3. Samples shall be collected in the spring and fall to avoid summertime spawning situations when the fat and protein content of shellfish can vary widely.

4. Replicate samples of 10 shellstock each shall be collected for both pesticide and heavy metal analysis. This means that a minimum of 40 shellstock are to be collected at each station.

5. Shellstock for pesticide and heavy metal analysis are to be shucked into Whirl Pac type plastic containers (there is no longer a need to use glass jars) and frozen for later delivery to DCLS for analysis. Therefore, there will be 2 bags each of 10 shucked shellfish for pesticide analysis and 2 bags of shucked shellfish for heavy metal analysis per station sampled.

6. Commercial harvesters may be used for sources of shellstock as long as they are observed collecting the shellfish from the station. Likewise, shellstock can be collected from commercial aquaculture areas.

7. Shellfish reach equilibrium concentrations of pesticides much more rapidly than heavy metals. Should the field director want to monitor a site for pesticides, such as near a large plasticulture area, and there are no naturally occurring shellfish available, shellfish from other areas can be brought in. Shellfish should be obtained from offshore areas with good dilution, where there is little concern for local pesticide contamination, and a replicated subset shall be shucked and frozen to provide an indication of initial concentration. The remainder of the shellfish, which are placed in the area to be tested, need only be left for a few days - a minimum of 3 at least. Heavy metal analysis should not be done if left for such a short period of time, since this could be improperly interpreted. Shellstock transported from an outside area for heavy metal analysis would need to be left a least one month. Furthermore, shellfish should be taken from a similar salinity regime, since oysters are known to concentrate most heavy metals to a higher degree in lower salinity water. (Positively charged heavy metal ions compete with other positively charged metal ions like sodium in higher salinity water for active sites in shellfish on which to attach, thus concentrating to lower amounts in higher salinity water).

8. Information recorded at the sampling location should include date, GPS coordinates and salinity.

9. Sample numbers shall be assigned by the field office to indicate the water body. Probably the easiest way to do this will be to continue with the convention used for years, in that the first letter of each word of the water body is used. For example, Lancaster Creek could be labeled LC; a Long Creek in that field office could be LOC, using the first two letters of Long Creek. The important point is that a simple, unique water body code be assigned to each sample.