STREAM CONDITION INDEX REFRESHER AUDIT
LAB AUDIT REPORT

Aquatic Ecology and Quality Assurance Section
Florida Department of Environmental Protection
2600 Blair Stone Road, MS 6511
Tallahassee, Fl 32399-2400

Scope of Audit

Samplers or field organizations that submit Stream Condition Index (SCI) data to the Florida Department of Environmental Protection (DEP) must pass an initial field audit and then pass a refresher audit every five years, per DEP SOP SCI 1300. The refresher audit requires the sampler or field organization to collect an SCI sample at a designated DEP SCI Benchmark Site and submit the sample to a laboratory for processing, following DEP SOP SCI 1000, which includes lab sample sorting, lab taxonomic identification, and calculation and reporting of the SCI index resulting from the sample analysis. The sampler or field organization demonstrates continuing proficiency (and is designated with a "pass" status in the DEP Bioassessment Registry) if the reported SCI score is no more than 19 points lower than the median SCI score for the Benchmark Site. An SCI result that is within the acceptance criteria established for the respective benchmark site provides assurance to DEP that both the sampler or field organization and the taxonomic lab are properly following the DEP SOP. To provide further assurance that the macroinvertebrate taxonomy lab is following the sample processing and index calculation protocols in the SOP, DEP conducts an audit of the required documentation associated with the refresher audit sample analysis to better determine how closely the lab complies with the procedures in DEP SOP SCI 2000. Note that the procedures and quality control for sorting and taxonomic identification assessed during this audit are the same as those required for the macroinvertebrate Wetland Condition Index (DEP SOP LT 7600).

Audit Outcome

DEP found that the FDEP Central Laboratory Biology Section macroinvertebrate taxonomy lab procedures complied with DEP SOP SCI 1000 for sample sorting, taxonomic identification, and index calculation.

Field Sampling Organization/ Sampling Personnel:	FDEP Central Lab / Cheryl Swanson, Jen Weger, Jackie Savage
SCI Benchmark Site:	Mule Creek
Sample Collection Date:	05/16/13
Macroinvertebrate Lab(s):	FDEP Central Lab, Biology Section
Analysis Date(s):	07/31/13 - 08/07/13
Auditor(s):	Diana Thurman, Joy Jackson, Nia Wellendorf, Michael Blizzard
Records Provided Date:	08/21/13
Audit Report Date:	09/24/2013 (Draft), 10/30/2013 (final)
Copies of Audit Report to:	Russ Frydenborg (DEP), Kevin O'Donnell (DEP), David Whiting (DEP)

Records Evaluated

The following records (with file names) were submitted to DEP by FDEP Central Lab and evaluated for this audit:

- Sample sorting bench sheets (Benchsheet_Mule Creek_5-16-2013.pdf),
- Taxonomic identification bench sheets and electronic raw taxonomic data (Benchsheet_Mule Creek_5-16-2013.pdf, TaxaEntered_MuleCreek_5-16-2013.xlsx),
- Description of corrective actions (FDEP Lab SOP IZ-13 and IZ-40),
- Taxonomic keys most frequently used (RE_SCI Refresher Audit - Lab component.pdf),
- List of verified taxa in reference collection (Complete Ref Collection Apr 2013.xls),
- QC records for sorting for 2012 (Sorting efficiency 12 months.xlsx, SCI samples with QC-12 months.xlsx, Amanda Chown.pdf, Hank Neeley.pdf, Jahquan Ingram.pdf, Monica Flores.pdf),
- List of SCI samples analyzed in 2012 and QC records for taxonomic identification for 2012 (SCI samples with QC-12 months.xlsx),
- Collapsed taxa lists and taxonomic attributes for metrics (Mule Creek_5-16-2013.xlsx, 71500_SCI_LIST_WITH_ATTRIBUTES.xlsx),
- Metric values and SCI score value (Mule Creek_05-16-2013.xlsx).

Audit Findings

Lab Quality System: The FDEP Central Lab conducts all quality control (QC) measures as required by the SCI SOP.

Sample Sorting and Identification Process: Overall, the sorting and identification process follows the DEP SOP. Samples were properly homogenized and subdivided to achieve the final two replicates. A total of 148 organisms were picked from Replicate #1 and 157 organisms from Replicate #2, both of which are within the target range of 140-160 organisms.

Some documentation associated with sorting and identification was unclear or absent. The handwriting on the benchsheet was difficult to discern, which was made more difficult by the quality of the copy or scan of the document reviewed by auditors. Additionally, there were no comments or notes on the benchsheet regarding which specimens were mounted or if any were removed for specimen collection or expert identification, if applicable, although there were spaces on the benchsheet for such comments. The total number of mounted taxa and individuals is recorded on the benchsheet; however, the FDEP lab does not record the number of slides associated with each replicate. Each slide and vial is linked to the benchsheet by a unique bar code label and replicate number recorded on the slide, and mounted taxa names are written on the label. However, there is insufficient documentation on the bench sheet to indicate how many slides and vials are associated with each replicate of the sample. Including this documentation would provide additional tracking and linkage between specimens and the benchsheet, and make it easier to account for the full sample, if needed.

Sample Sorting QC: FDEP conducts a QC check on a minimum of 10% of aliquots sorted for each replicate with a minimum of at least one aliquot per replicate. Quality control evaluation of sorting efficiency follows the DEP SOP procedure, and all analysts are performing sample sorting with greater than 95% efficiency.

Taxonomic Identification QC: The FDEP laboratory taxonomic identification procedures and quality control evaluations of individual taxonomist performance meet DEP SOP requirements. All analysts perform identifications at a greater than 95% correct identification rate for individual organisms and taxa. QC checks are performed on one of every 20 samples processed per analyst, which meets the 5% QC checks per year. Due to the short time lag between when a sample was processed and when the QC check was conducted, the calculated percentage of QC samples for the past 12 months was slightly less than 5% (4.7%).

***SCI Index Calculation**:* FDEP correctly classified taxa according to their attributes. The calculations for the ten metrics were performed according to the FDEP SOP, and were appropriate for the SCI region and year.

Corrective Actions

Although no deficiencies were found, the auditors recommend that analysts write more legibly on bench sheets, and record the number of slides associated with each replicate, in order to facilitate the review of documentation associated with the sample analysis and to reconstruct each sample replicate.

More detailed audit findings are contained in the audit checklist below.

Lab Records Audit Checklist for SCI sampling processing and data analysis			
Lab: FDEP Central Laboratory, Biology Section ***Sample: SCI Refresher Audit sample, sampled 5/16/13 by FDEP Biology Section, Mule Creek***			
PERFORMANCE MEASURE		**PERFORMANCE ASSESSMENT**	
		Assessment	**Remarks**
1. Lab quality system (SCI 2200, LQ 7400 1. General Requirements) - *Could apply to SCI, BioRecon, LCI, WCI, Hester-Dendy, Dredge, or Core sample analysis*		***Refer to list of taxonomic keys and list of reference collection specimens to address the following requirements.***	
1.1	Lab maintains copies of appropriate taxonomic identification keys.	YES	Lab taxonomic key list is comprehensive and includes Merritt and Cummins (2008) and keys for mayflies, stoneflies and dragonflies.
1.2	Lab maintains taxonomic specimen collection.	YES	
1.3	Taxa found in samples are represented in the reference collection.	YES	Checked taxa from five (5) orders and verified that they were on the reference collection list.
1.4	Lab retains extramural experts to verify identifications.	YES	Multiple outside experts utilized based on specimen type.
1.5	Specimens in collection are verified by extramural expert.	YES	Some specimens did not have a verification taxonomist listed and on occasion the verification taxonomist was an internal staff person. This may be acceptable depending on the level of identification difficulty. Extramural experts are to be used if there is any level of uncertainty.
1.6	Lab contains basic equipment necessary for sorting and taxonomic analysis (compound and dissecting microscopes, divided trays, #30 sieve) [applicable to lab visit audit only]	N/A	Auditor did not visit the lab, so this element was not evaluated.
2. Sample sorting and identification process (SCI 2100) - *Applies to processing for SCI samples, other samples that follow LT 7010-7040*		***Refer to raw bench sheets to address the following requirements.***	
2.1	Sample homogenized and subdivided at prescribed levels; records indicate fractions of samples sorted and reflects that 2 or 3 trays were used (may only have 2 if insufficient material to warrant	YES	Fractions of sample picked were 13/144 (9.03%) for Rep 1 and 12/144 (8.33%) for Rep 2 as listed on taxonomic ID bench sheets. Each Replicate went through three sorting trays.

	3 trays)		
2.2	Two aliquots of 150 (±10) organisms picked from sample material.	YES	Replicate #1 had 148 total organisms; replicate #2 had 157 total organisms.
2.3	The X qualifier is used if insufficient organisms are in the sample to obtain 2 replicates of 150. (only applicable if <300 organisms were in the sample)	N/A	Sufficient material for two reps of 150.
2.4	Analysts prepare slides and use a compound microscope for identification of appropriate groups when needed (typically worms, midges, mites)	YES	
2.5	Individual taxon names and counts are recorded on benchsheet	YES	Note: legibility of the handwriting on the benchsheet was poor and reading difficulty was compounded by the quality of the photocopy/scan.
2.6	Slides clearly identified and linked to the sample vials and sample data sheets by unique sample ID and specimen ID	YES	Slides not examined for audit, but Cheryl Swanson of FDEP indicated that each slide gets the same bar code label and replicate number as the benchsheet, and taxa names are recorded on the label.
2.7	Taxonomic benchsheet indicates when specimens are removed from sample vial for any reason (e.g., placed in reference collection or send to extramural expert).	N/A	No notes for specimen removal were observed on the benchsheet.
2.8	Taxa collapsing routine conducted per SOP SCI 2100 section 4 or LT 7040. Original and collapsed taxonomic lists maintained.	YES	FDEP has a database (SBIO) that performs the taxa collapsing routine.
2.9	Documentation available for items listed in SCI 2110	NO	FDEP does not track organisms sorted from each selected grid tray aliquot, but tracks the total number from all aliquots and trays combined. FDEP does not track the number of mounted slides prepared for each replicate; however, the slide labels provide linkage to the replicate.
3. Sample sorting QC (SCI 2210, LQ 7410) - *Applies to processing for SCI, LCI, WCI, Hester-Dendy, dredge or core samples*		***Refer to sorting efficiency tracking records, corrective action protocol, list of analyzed samples, and raw bench sheets to address the following requirements.***	
3.1	Sorting efficiency check conducted for a minimum of 10% of aliquots per replicate.	YES	FDEP conducts QC checks on a minimum of 10% of aliquots for each replicate.
3.2	Sorting efficiency calculation conducted per SOP (LQ 7410 1.4)	YES	
3.3	Sorting efficiency tracked for each analyst.	YES	Running log maintained for each analyst.
3.4	Cumulative sorting efficiency 95% or greater for each analyst.	YES	
3.5	Precautionary measures taken when single-analyst cumulative sorting efficiency falls below 95%.	YES	
3.6	Corrective action taken when single-analyst cumulative sorting efficiency falls below 90%.	YES	
3.7	Documentation available for items listed in SCI 2211	YES	

4. Taxonomic identification QC (SCI 2220, LQ 7420) - *Applies to processing for SCI, LCI, WCI, Hester-Dendy, dredge or core samples*		***Refer to taxonomic QC tracking records, corrective action protocol, list of analyzed samples, and raw bench sheets to address the following requirements.***	
4.1	For freshwater sampling, identify taxa to the lowest practical taxonomic level as listed in Table LT 7900-1 or SCI 2230.	YES	Not able to read taxa specimens on benchsheet due to handwriting and copy quality. An electronic copy of taxa "as entered" was reviewed by Joy Jackson (auditor) who found the taxonomic levels were acceptable.
4.2	Quality control performed on 5% of samples (or SCI replicates), per LQ 7420 section 3 or SCI 2220 section 1.	YES	Between 07/2012 - 08/2013, QC checks were performed on 4.7% of all replicates processed (35 of 741 replicates processed), most of which occurred in 2013. The list provided by FDEP did not include Round Robin samples, which when added to the list, yielded a QC frequency of greater than 5%. The FDEP laboratory taxonomists randomly select one of every 20 samples analyzed for QC by another analyst, so that process ensures that 5% of samples receive QC check. A minimum of at least one sample QC per year was conducted.
4.3	Taxonomic discrepancies associated with the QC check resolved through use of extramural expert when needed. (may only be able to evaluate this element if corrections were made on bench sheet)	YES	The refresher audit sample (Mule Creek, sample ID 1505250) was not selected for a QC check. The lab does have several expert taxonomists on staff who also consult with extramural experts when necessary.
4.4	The single-analyst cumulative correct identification rate is 95% of the total number of individual organisms and 95% of taxa identified in all samples or subsamples enumerated by the analyst (5% cumulative error rate over 12 months)	YES	All analysts have an identification rate > 95% for individual organisms and taxa.
4.5	Documentation available for items listed in LD 7232 or SCI 2221.	YES	
5. SCI Index calculation (SOP SCI 2100 section 5.) - *Applies to SCI only. Additional checklist would be needed for other indices.*		***Refer to SCI metric and index calculation records to address the following requirements.***	
5.1	Taxa correctly labeled as long-lived, sensitive, and very tolerant per SOP SCI 2100 section 5.1-5.3	YES	All taxa were accurately categorized. Note that all Elmidae will be considered clingers per revised QA Rule, not yet effective (2008 Merritt et al.).
5.2	Taxa correctly assigned to the following taxonomic groups, as required for metric calculations in SOP SCI 2100 section 5.4: Ephemeroptera, Trichoptera, Tanytarsini tribe	YES	
5.3	Taxa correctly labeled as having a clinger or filter feeder habit, per Merritt and Cummins, An Introduction to the Aquatic Insects of North America (SOP SCI 2100 section 5.5)	YES	
5.4	Sample correctly assigned to SCI region	YES	

5.5	Metrics and index calculated for each replicate following instructions in SOP SCI 2100 Table SCI 2100-1 and steps 1-6 following the table.	YES	Metrics calculated for each replicate, but the SCI score for each replicate was not provided. The auditor calculated the replicate SCI scores from the raw data, and the resulting average matched the reported SCI score of 69. The correct region and year calculator was used.

	Performance Assessment Remarks	FDEP Laboratory Explanation and/or Corrective Action	Approved by AEQA auditors
2.9	FDEP does not track organisms sorted from each selected grid tray aliquot, but tracks the total number from all aliquots and trays combined. FDEP does not track the number of mounted slides prepared for each replicate; however, the slide labels provide linkage to the replicate.	The specific number of individuals picked from each aliquot is not used in any calculation, and is not included in the instruction steps of the SOP. The FDEP laboratory staff will begin documenting on the benchsheet the number of slides associated with each replicate.	10/30/13