SFS Taxonomic Certification Program

Annual Report for 2023

By Bern Sweeney and Michael Broomall

2023-2024 Committee Report: SFS TCP Committee

Chair/Co-Chairs:
Bern Sweeney (Co-Chair; sweeney@stroudcenter.org)

Voting committee members (appointed)
Michael Floyd
Gary Lester
Richard Mitchell
Tony Roux
Andrew Short
Sarah Spaulding
James (Sam) Stribling
Mark Wetzel

Non-Voting members:
Michael Broomall

The Society for Freshwater Science Taxonomic Certification Program (TCP) was established in 2005 to test the taxonomic skills of people involved in benthic macroinvertebrate studies in North America. The program is currently based and managed out of the Stroud Water Research Center (SWRC), Avondale PA as an informal cooperative agreement between SWRC and SFS. The certification program is viewed by the USEPA and Environment & Climate Change Canada as a valuable measure of taxonomic ability. The accurate and precise identification and classification of organisms provides the foundation for all biological investigations of the ecology of our freshwater systems, as well as biomonitoring programs aimed at evaluating the environmental health of these systems. Accurate identifications of the organisms present are required to yield credible ecological and reliable bio-assessment results.

Genus/Species level testing:

In 2023, the TCP performed 107 specimen/image-based genus-level tests conducted at 87 events resulting in 75 newly certified or re-certified taxonomists.

This compares favorably to 2022, in which the TCP performed 71 specimen/image-based genus-level tests conducted at 60 events resulting in 51 newly certified or re-certified taxonomists.

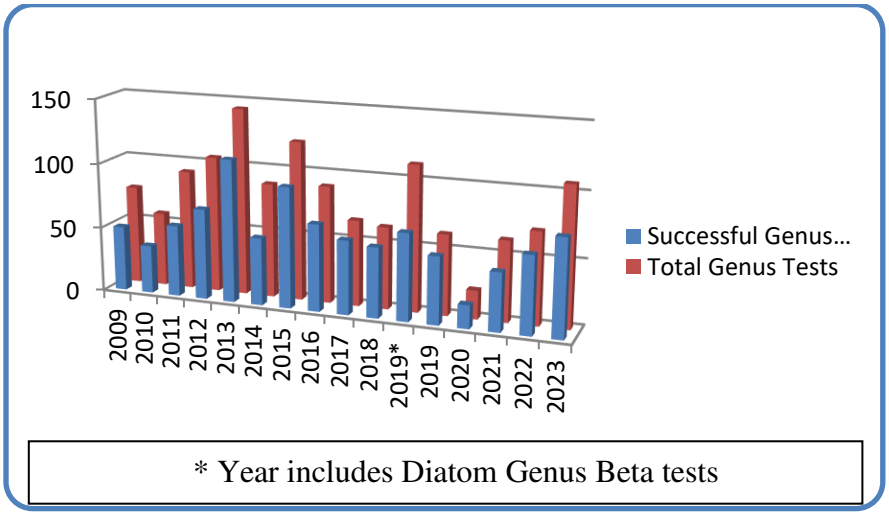
More tests were administered in 2023 than in 2022 and the numbers have surpassed pre-Covid year's totals. 2023 was the 4th highest year with regard to number of tests since 2009 (3rd if excluding diatom beta testing in 2019)!

The macroinvertebrate certifications were achieved with accurate identification of ≥95% of specimens or images on a practical test. There was an 85.22% success rate of the 88 individuals taking the genus-level exams in 2023.

SFS Taxonomic Certification Program

The genus macroinvertebrate tests are comprised of several various types (EPT, Chironomidae, General Arthropod & Diatom (Level 1 and Level 2), sometimes by geographical location (East or West) and by exam type (digital or specimen). The diatom tests are all image based or multiple choice question and answer.

Genus-Level Tests (Specimens and Images) 2009–2023



The genus-level tests macroinvertebrate tests are conducted with specimens (east and west General Arthropods), specimen slides (Oligochaeta), or images (east and west Ephemeroptera-Plecoptera-Trichoptera and Chironomidae). The genus/species tests help evaluate the test takers ability to find and assess diagnostic characters which are important for professionals using genus- or species-level protocols. These tests are also being used as end of term options offered by professors for students wishing to bolster their CV's as well as at the end of taxonomic workshops offered across North America in both Canada and the United States. The test candidates must identify 19 of the 20 specimens or image collages correctly for a score of ≥95% to gain certification. A successful macroinvertebrate certification lasts for 5 years and is posted on the TCP website during this time. The diatom certification lasts 7 years. A summary table of all exams given can be seen below for 2023 (Table 1).

Genus-level Macroinvertebrate Re-Certifications by Petition (TCC):

In 2012 the TCC drafted and approved a Re-Certification Petition procedure. This allows certified taxonomists to choose to renew their certifications after 5 years by petition rather than a retake of the actual test. To date there have been 65 petitions submitted for certification renewal and all have been successful. However, there were no petition requests in 2023.

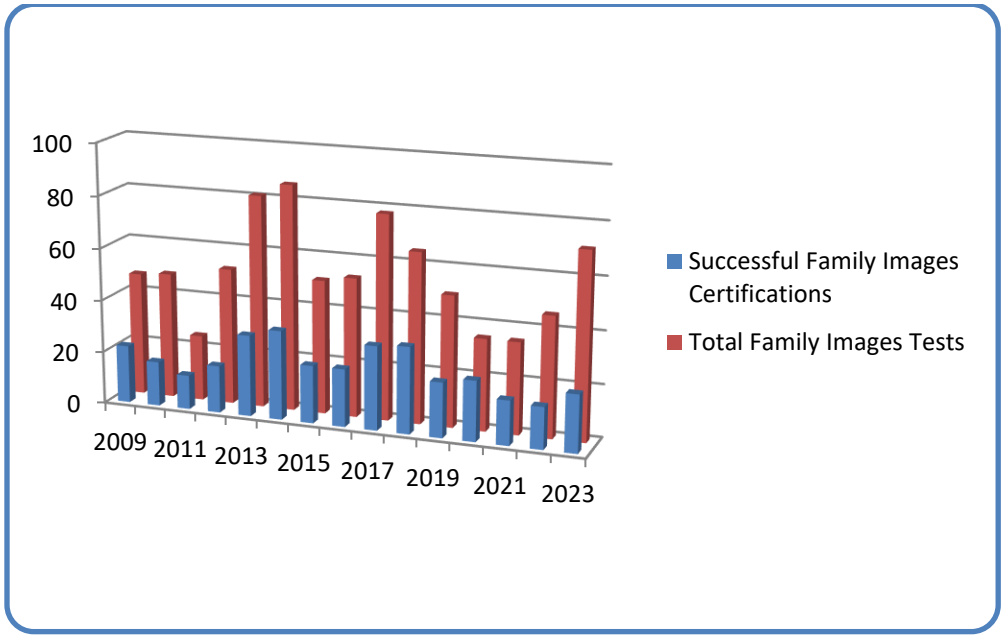
SFS Taxonomic Certification Program

Family Level Macroinvertebrate Testing:

Family-level Macroinvertebrate Certification is accomplished with successful identification of at least 38 of 40 (95%) web- and USB-based image collages. These image-based tests are a cost effective means for evaluating a test takers ability at the family level. For the family level test, images covering a wide range of aquatic insect families were originally produced by Dr. Colbo in 2013 and later updated in 2022 to enhance testing. The web-based, family-level tests are attractive not only for professionals using family-level protocols, but also for volunteer citizen-scientists who may be assisting biomonitoring programs. These tests are also being used as end of the semester options offered by university professors teaching taxonomically related courses and for students at the end of workshops interested in bolstering their CV's. The collage of test images can be viewed and practiced for free on the self-evaluation portal of the TCP website, www.stroudcenter.org/sfstcp/quiz.

Family-level, image-based tests in 2023 were administered 71 times with 22 persons being certified at the family level. This compares favorably with 2022 when 64 were administered and 16 persons were successful. Note also that we have surpassed pre-Covid results (2019) when 50 tests resulted in 21 certifications. In 2022, of the 64 individuals that took the family-level exam, their success rate was 34.37%, with an average score of 83.9.0%. The lower success rate (when compared to the genus-level exams) is thought to be due to the test being taken by students and people working with community groups who have less experience than those working at the genus level. Three college/universities used the family level test as part of their evaluation in 2023 whereas only one university did it in 2022.

Family level Tests (Images) 2009-2023



SFS Taxonomic Certification Program

Order Level Macroinvertebrate Exam:

For its first full year of use (2023), there were 7 test takers for the order level macroinvertebrate exam with 4 individuals passing.

Fish Test Development Update:

There is currently a technical workgroup developing a taxonomic certification exam for fish. The group is being led by Lou Reynolds, a USEPA Region 3 fish biologist, in their Wheeling, WV, Aquatic Biology Laboratory. Three members of the TCC and TCP are working with Lou, including Sam Stribling, Richard Mitchell, and Mike Broomall (TCP coordinator), to help with the test structure and logistics. The group holds monthly calls and are considering offering exams to cover either state-level fauna (yes, potentially 50 different exams!) or some combination of state / regional tests to broadly represent regional, multi-state faunas. At the upcoming 2024 SFS conference a "special session" talk will be given to introduce this new exam. A demo exam will be displayed at the conference and comments will be welcomed.

The general arthropod exam is being digitized by Clemson University Light Imaging Lab. Images are expected to be mostly completed by March 2024, with a demo available for viewing by potential candidates at the AMAAB meeting at the end of March.

Diatom Taxonomic Certification Committee Report:

Members of the committee include:
Sylvia Lee (chair, USEPA)
Heera Malik (Rhithron)
Mariena Hurley (Patrick Center)
Kyle Scotese (EnviroScience)
Julianne Heinlein (GLEC)
David Burge (Science Museum of Minnesota)
Mark Edlund (Science Museum of Minnesota)
Sarah Spaulding (US Geological Survey).

We congratulate Jan Stevenson on his retirement and appreciate his contributions to the Diatom TCC!

Since the last annual report, the Diatom TCC facilitated an open discussion with the diatom community about taxonomic certification at the 2022 North American Diatom Symposium (NADS) held in Brazil, Indiana from September 21-25. In 2023, the Diatom TCC met bi-weekly to finalize and release the Species (level 2) exam. The Species exam will serve as a valuable component of contract requirements, professional development, and education for practitioners and members of the diatom research community. The Species exam was designed to test the skills that analysts may be required to use for biological assessment projects that include enumeration of diatom taxa at the species level. For example, the Pennsylvania Department of Environmental Protection will include Species Level 2 Diatoms certification for future contracted work. The Diatom TCC now meets every month and is working on updating questions and image collages for both Genus (level 1) and Species exams. The Diatom TCC thanks Mike Broomall for administering the exams, following up with questions from the candidates, and implementing updates to the exam questions.

SFS Taxonomic Certification Program

SFS annual meeting activities: Members of the Diatom group will also help organize a special session at the 2024 SFS on algal taxonomy. The title of the special session is "Algal taxonomic data: embracing new protocols and analyses" and the lead organizer is Julianne Heinlein. The Diatom group will also plan to participate in the taxonomy fair at SFS. Finally, there are plans for a field trip during the week of SFS to the Academy of Natural Sciences of Drexel University in Philadelphia, PA including the Diatom Herbarium.

Diatom Web Academy: Since it first kicked off in 2020, the Diatom Web Academy continues to draw international participation (https://diatoms.org/news/diatom-web-academy-24) with a total of 17,000 views. In 2023, there were 16 webinars and over 6,870 views of recorded presentations (https://www.youtube.com/@nadiatoms2773/playlists) and viewership is increasing. The YouTube channel has over 375 subscribers and over 60 videos as of February 2024. The webinars are continuing to be a valuable resource for communication, education, and professional connection among the certified and to-be-certified diatomists. Below are the speaker's names and titles of webinars from 2023:

1. Somayyeh Kheiri, Research Institute of Forests and Rangelands, Iran
   The Lut Desert and its diatoms
2. Sunlin Hu, Minxue Scientific Company, Guangzhou, China
   An improved SEM-based method for the forensic diatom test
3. Euan Reavie, Natural Resources Research Institute, University of Minnesota Duluth
   The loss of diatoms in the world's largest freshwater resource
4. Nate Smucker, US Environmental Protection Agency
   Using diatom DNA metabarcoding for stream monitoring and indicator development
5. John Smol, Queens University
   From tundra ponds to the "Northern Great Lakes": Climate-driven regime shifts in Arctic ecosystems
6. Ruchi Battacharya, University of Waterloo
   Big data in limnology
7. Veronica Hamilton, Ball State University
   Voucher diatom flora from fens in the Tanana River floodplain, Alaska
8. Rosa Trabajo, President, International Society for Diatom Research
   Early Career Research Grants
9. Sarah Spaulding, INSTAAR, University of Colorado
   A peek at the diatoms.org upgrade
10. Jasmine Saros, University of Maine
    Deciphering climate-lake linkages by coupling diatom ecology with lake sediment records
11. Karolina Bryłka, Lund University
    Uncertainties surrounding the oldest fossil record of diatoms
12. Regine Jahn, Botanischer Garten und Botanisches Museum Berlin-Dahlem
    How to name diatoms from taxonomic studies - integrating type information, morphology, and sequence data
13. Daniel Conley, Lund University
    Perspectives on the emergence of diatoms and their impact on the global biogeochemical cycle of silica
14. Sylvia Lee, US Environmental Protection Agency
    Diatom Certification Level 2 Species Exam
15. David Harwood, University of Nebraska
    The great grandmother diatoms
16. Marco Cantonati, University of Bologna, Italy
    Spring habitats as living repositories of biodiversity

17. Bart van de Vijver, Meise Botanic Garden & University of Antwerp, Belgium
    The detective in the museum

SFS TCP Website Development:

SFS-TCP pages and event listings received a total of 12,725 page views in 2023. This was lower than the 21,688 in 2022 but likely reflects Google Analytics moving to a new version that was radically different from the old version. Our free demo of the family level exam and diatom exam which is located at http://stroudcenter.org/sfstcp/quiz had 588 and 30 (respectively) attempts in 2023.

SFS TCP Test Proctoring:

With every effort being made to accommodate busy laboratories and their employees, we have been able to offer the image tests "in house" and have them supervised using web cameras interfacing the TCP administrator and the test candidates. Candidates greatly appreciate being able to take the exam remotely.

Thanks to everyone who gave their time and/or space to help facilitate and supervise testing. Without that support and time the program would not exist.

Looking forward the SFS TCP in 2024:

The 2024 annual SFS conference will be held in Philadelphia, PA June 2–6, 2024. The 2024 annual meeting of the TCP committee will be held in person as well as virtually on June 3 at 4:00pm EST.

Release of the digitized version of the genus level exam for East and West General Arthropods.

Possible development of a pilot Digital Fish Exam in partnership with American Fisheries Society.

Create a Spanish and Portuguese version of the SFS TCP website as well as translating the text associated with three digital taxonomic certification tests and piloting the Spanish/Portuguese website and certification tests in cooperation with the SFS Latin American Chapter (LAC) as a tool for engaging undergraduates and citizen scientists regarding freshwater issues.

The SFS TCP will also be co-sponsoring and directing (along with the SFS TIC) the 2024 SFS Taxonomic Fair in Philadelphia at the SFS Annual Meeting.

At the administrative level, John Morse retired from the TCP committee in 2023 after his presentation regarding the SFST TCP at the SFS Annual Meeting in Brisbane Australia. John was one of the founding members of the TCP Committee back in 2001 and has served on the committee without interruption since that time. He has co-chaired the committee with Bern Sweeney almost since its inception. Many thanks to John for all his hard work over the years on behalf of the TCP!!!!

SFS Taxonomic Certification Program

Fiscal activity for the year 2023:

The financial results through December 31, 2023, are shown in Table 2.
Revenue received as of December 31, 2023, from tests collected by Stroud was **US $30,325**.
Expenses received as of December 31, 2023, was US $29,978. A gain of $347.

Account balance as of December 31, 2023, was US $46,366.80.

Projected approximate budget costs for 2024 (US $):
$31,200 ($26,200) for digitizing general arthropod exam ($5000 paid by SFS)
$ 9,000 for services of Michael Broomall
$ 6,000 for office rent, indirect costs, & office supplies (SWRC)
$ 1,000 for shipping exams
$ 300 for annual fees from online test portal http://www.classmarker.com

Total projected costs $47,500

Projected Revenue 2024 (see Table 3 for 2023 realized revenue):

$30,000 from test revenues (50 genus- (insects), 50 genus- (diatoms), 20 Species (diatoms) & 50 family-level at SFS Member rate)

Total projected Revenue: $26750 (at SFS Member Rate) - $36250 (at NON-SFS-Member Rate)

After digitizing the general arthropod exam, I expect that the handling time of the exam to decrease significantly as resorting and checking on the specimens after each test can take up to 2-3 hours in order to make sure the specimens are ready for shipment. The digital version will eliminate this time and additionally we will not have the costly shipping costs too.

Please note that expenses can vary from those budgeted. However, if exam numbers decrease, expenses also decrease proportionately because services are not being provided and do not accrue.

SFS Taxonomic Certification Program

Table 1: Summary of exams given in 2023.

Exam	# taken	# Individuals	# passed	% successful	Avg Score %	Avg Time duration
Order	7	5	5	100	92.1	21 min
Family	71	64	22	34.38	83.9	1 hr 56 min
East EPT (Classmarker)	38	29	25	86.21	93.6	2 hr 10 min
East EPT (USB)	5	5	4	80.0	96	NA
West EPT (Classmarker)	12	10	10	100	96.7	1 hr 55 min
Chironomidae (Classmarker)	23	17	16	94.12	93.9	2 hr 23 min
Diatoms Level 1	8	6	3	50	83.8	1 hr 48 min
Diatoms Level 2	9	9	9	100	97.4	2 hr 14 min
General Arthropods (Both)	7	7	4	57.14	89.29	NA
Petitions (various groups)	0	0	0	NA	NA	NA
Oligochaeta	4	4	4	100	97.5	NA
Total Exams (2023)	184	156	102	80.19	NA	NA
Total Exams (2022)	136	117	85	78.23	NA	NA

SFS Taxonomic Certification Program

Table 2: 2023 Revenue and Expenses

SFS Taxonomic Certification Program, Adminstered by Stroud Water Research Center					
Account Balances 12/31/2022	**45,776**	-	**1,195**	**(0)**	**46,971**

2023 Revenue	Test Administration	Test Development (Digitize General Arthropods)	Test Development (diatom test-species)	Test Development- (Field testing of Order level)	Total
Taxonomic certification tests	30,325				30,325
Grants from SFS Strategic Plan Discretionary Fund					
Development of diatom test			-		-
Digitize General Arthropod Exam		5,000			5,000
Field testing of macroinvertebrate test				-	-
TOTAL Income	30,325	5,000	-	-	35,325

2023 EXPENSES	Test Administration	Test Development (Digitize General Arthropods)	Test Development (diatom test species)	Test Development- (Field testing of Order level)	Total
Salaries	(13,339)		(600)		(13,939)
Fringe	(4,160)		(189)		(4,349)
Office Supplies	-				-
Laboratory supplies	(46)				(46)
Computer charges/usage	(202)				(202)
Software Licensing fees	-				-
Travel	-				-
Mileage	(455)				(455)
Tolls	(16)				(16)
Professional Meetings					-
Postage	(125)				(125)
Postage-- overnight delivery	(766)				(766)
Membership dues	(90)				(90)
Professional Training					-
Credit card fees	(605)				(605)
Imaging Fee to Diatom Group for student contractor, University of Colorado Boulder					-
Imaging Fee to Clemson University Light Lab		(13,000)			(13,000)
Indirect costs	(10,175)		(418)		(10,593)
TOTAL Expenses	(29,978)	(13,000)	(1,207)	-	(44,186)
Net Income FY 2022	347	(8,000)	(1,207)	-	(8,861)
Accounts balance 12/31/2023	**46,122**	**(8,000)**	**(13)**	**(0)**	**38,110**

Table 3: Realized Revenue for 2023 (by exam type)	# taken	Revenue
Order	8	$165
Family	62	$4850
Genus (includes petitions n=0)(& Diatoms Lvl 2)	82	$21350
Year total	153	$26,365
Unapplied funds (exam credits)		$5,375

Submitted February 24, 2024 by Dr. Bern Sweeney, Chair and Michael Broomall, Assistant Coordinator, SFSTCP, Stroud Water Research Center Avondale PA USA.