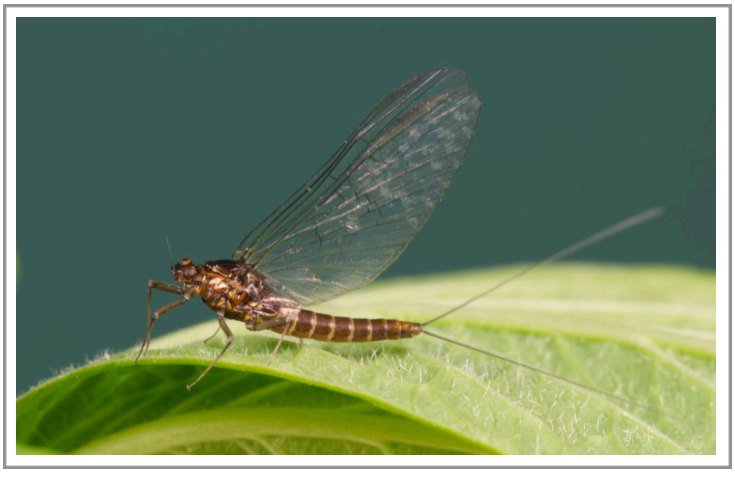
2014
LOWER DESCHUTES RIVER MACROINVERTEBRATE HATCH ACTIVITY SURVEY RESULTS

DESCHUTES RIVER ALLIANCE



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Last, thanks to all those not mentioned here who care about the Deschutes River and have contributed hours of their time to better understand the river's ecology, and to all those who have provided critical financial support to understand and protect its health.

A thing is right when it trends to preserve the integrity, stability and beauty of the biotic community. It is wrong if it trends otherwise.

Aldo Leopold in "Meditations from the Wilderness" edited by Charles A.E. Brandt

EXECUTIVE SUMMARY

Changes in adult insect abundance have been an ongoing concern of fishing guides and long-time anglers on the Deschutes River since operation of the Selective Water Withdrawal tower at the Pelton-Rond Butte Hydroelectric Project began in 2010. During the 2014 fishing season concerned guides and long-time anglers submitted 100 aquatic insect hatch abundance surveys over the period from May 10 through the end of October. Each survey ranked the abundance of 17 possible aquatic insect adults on a scale of from 0 to 3; 0 indicating no adults present, 1 low numbers, 2 moderate numbers, and 3 high numbers. While qualitative, such rankings provide a good indication of the general abundance of adult insects. All those submitting surveys have a long history of experience fishing the river and observing adult insect activity.

Survey results found few adults present in high numbers. Those with the largest percentage of high abundance were salmonflies (17% of surveys ranked as high) and golden stones (14%). Net-spinning caddis and Diptera were next highest at 13% and 12% of surveys noted with high numbers of adults, respectively. Mayfly adults were noticeably sparse with just 4 surveys out of 100 indicating high numbers of adults. Overall, caddisflies were most widespread and common, but still dominated by low to moderate numbers of adults. The crane fly *Antocha* continued to show the most troubling decline with virtually no adults seen along the entire lower river (a small number of adults observed on only 3 occasions throughout the survey period), compared to large numbers of adults present in years before surface water withdrawal began.

An assessment of six separate stream reaches found low numbers of adults to be relatively consistent along the entire length of the lower river from the Warm Springs Bridge to the mouth. One possible cause for a decline in insect numbers is the proliferation of two stalk-forming diatom species noted in the lower river over the past several years. Unlike other beneficial diatoms that

provide a significant food source for many aquatic insect larvae, these diatoms produce dense growths of indigestible stalks that not only lack food value, but also change habitat quality for invertebrates. Further studies are needed to evaluate changes in nutrient levels being released into the lower Deschutes as a result of surface water withdrawal, and if changes in nutrients are altering the algal communities downstream.

INTRODUCTION

Like any living organism, aquatic insects require adequate environmental conditions throughout their life cycle in order to successfully maintain their populations. For aquatic insects this means an underwater environment that supports their egg, larval and, for some, a pupal stage. They also require a terrestrial environment that allows adults to survive emergence, mate, and return to the water and successfully lay their eggs. There are therefore numerous points in their life cycle where a change in habitat or other conditions can impact their survival.

Changes in water temperature, for example, can not only alter larval growth, but also change how quickly or slowly eggs develop (Elliott 1972), both of which can affect when adults emerge, and thus the terrestrial environment the adults might face, plus the size of adults, which can change the number of eggs they produce (Sweeney & Schnack 1977). Changes in stream substrate can have significant effects on larval survival by altering the type of space available to live in and the type of food larvae have to eat (Hynes 1972). Another important factor is basic water chemistry. While aquatic insects have a range of tolerance to water quality factors like dissolved oxygen, pH, and nutrients (Ward 1992), changes in water quality can alter the type and abundance of their food, which can then change larval growth and survival. Finally, adults must survive days to weeks above water, usually in streamside vegetation, find mates, and then successfully lay their eggs in the proper habitat that protects the eggs until they hatch. A weak link in any part of this chain of requirements will impact insect populations.

To assess changes in aquatic insect populations, most studies evaluate the number and diversity of the larval stages that live along stream or lake bottoms (Hauer & Lamberti 2006). For this reason they are often referred to as "benthic invertebrate" studies. This approach can be effective at identifying population changes due to changes in environmental conditions.

Another approach is to evaluate the adult stage. One of the major concerns and issues raised by fishing guides and other long-term anglers on the lower Deschutes River, has been noticeable shifts in the emergence timing of some

adult insects and notable declines in the abundance of other adults following the start of the Selective Water Withdrawal (SWW) tower at Pelton Round-Butte Dam in 2010. The general intent of the SWW operation is two fold:

1) Alter the temperature regime in the lower Deschutes River so it reflects the combined temperature of the three tributaries that enter and form Lake Billy Chinook as if no reservoirs were present. This new temperature is referred to as the "Natural Thermal Potential" or NTP.

2) Provide for the successful reintroduction of anadromous fish above the three dams on the Deschutes by creating a surface current through Lake Billy Chinook. The surface current is critical for successful downstream migration through the reservoir of salmonid smolts planted in tributaries.

The amount of surface water from Lake Billy Chinook discharged from the SWW tower varies through the year, with the largest percentage - up to 95 percent - occurring in the winter and spring months. Besides increasing winter and spring temperatures downstream in the Deschutes River as intended, the surface water also appears to be changing the downstream water quality. It is speculated that this change in water quality, particularly changes in nutrient levels, is creating the observed changes in the aquatic ecology of algae and invertebrates in the lower river. For a more detailed discussion of how changes in temperature and water quality from the SWW's operation can impact aquatic insects, look at last year's hatch survey report, *Lower Deschutes River Macroinvertebrate Hatch Activity Survey Results* (Hafele 2014), which is available on the Deschutes River Alliance's website at: http://images.wolfpk.com/deschutesriveralliance/pdf/DRA-Macroinvert%20GuideReport-Last%20One.pdf

The goal of the hatch surveys is to document adult insect activity throughout the season and provide a qualitative assessment of changes in timing and abundance of major insect hatches in the lower Deschutes River. Assessing changes in adult insect activity with a high degree of statistical certainty is difficult at best, and not possible without an extensive research program and budget. However, consistent qualitative information collected by knowledgeable long-time river users can provide a valuable source of information and document changes occurring to the insects in the Deschutes.

SURVEY METHODS 2014

The survey form used in 2014 collected similar information as in 2013, but added specific information for 17 major insect hatches commonly found on the lower Deschutes River (Table 1). Also, in 2014 the Deschutes River Alliance (DRA) contracted with Ecotrust to develop an online app that allowed guides to fill out the survey information using a smart phone, tablet, or computer. This app was successfully developed and deployed in May 2014. As a result, the number of completed surveys rose from 33 in 2013 to 100 in 2014. The app also automatically uploads the data to an online data base, eliminating the need to hand enter data from hard copy survey forms. The use of this app created a much more effective process for data collection and analysis.

TABLE 1. Major hatches covered by surveys

MAYFLIES	STONEFLIES	CADDISFLIES	DIPTERA
Baetis sp. (Blue-winged Olive)	*Pteronarcys californica* (Salmonfly)	Brachycentridae (American Grannom)	Chironomidae (Midges)
Ephemerella excrucians (Pale Morning Duns)	*Hesperoperla pacifica* (Golden Stone)	*Rhyacophila* sp. (Green Rock Worms)	*Antocha* sp. (Crane Fly)
Heptagenia sp. (Pale Evening Duns)	Perlodidae (Yellow Sallies)	*Glossosoma* sp. (Saddle-case Caddis)	
Drunella grandis (Green Drake)	*Claassenia sabulosa* (Fall Stone)	*Hydropsyche sp.* (Net-spinning Caddis)	
Paraleptophlebia sp. (Mahogany Duns)		Hydroptilidae (Micro Caddis)	
		Dicosmoecus sp. (October Caddis)	

As in 2013, the survey recorded basic abundance information for the major insect hatches. Adult insect activity was recorded as "0" if no adults were seen, "1" if adults were present in low abundance, "2" if present in moderate abundance, and "3" if present in high abundance. Additional information covering date, location, weather, temperature (air and water if available), and fish activity was also recorded.

Guides collected data from May through October as follows:
May - 36 surveys completed; June - 27 surveys completed; July - 17 surveys completed; August - 12 surveys completed; September - 4 surveys completed; and October - 4 surveys completed. The drop in the number of survey forms returned from August through October reflects a shift in guided fishing trips from targeting trout to targeting steelhead.

RESULTS & DISCUSSION

Results for 2104 are summarized in Tables 2-7. As noted in the Methods section a total of 100 surveys were submitted by guides in 2014. Table 2 provides an overview of abundance observations for the four major orders of insects: mayflies (Ephemeroptera), stoneflies (Plecoptera), caddisflies (Trichoptera), and Diptera. Because each order has multiple species being observed and recorded, the total number of observations for each order will add up to more than 100.

Results in 2014 were similar to those found in 2013, with the majority of adult insect activity observed in low to moderate abundance and very few high abundance observations recorded for any of the major insect orders (Table 2). Caddisflies were the most abundant adults observed with 72% of observations reported as "low" abundance, 64% reported as "moderate" abundance, and 21% as "high" abundance. Mayflies showed some of the lowest abundance with 81% of records noted as low, 39% reported as moderate, and just 4% reported as high abundance. Stoneflies and Diptera had the highest number of records with no adults observed at 51% and 50%, respectively.

TABLE 2. Summary table of adult abundance for the four major insect orders.
0 = none observed 1 = low abundance 2 = moderate abundance 3 = high abundance

	Mayfly Adults	Stonefly Adults	Caddis Adults	Diptera Adults
Total # of surveys submitted	100	100	100	100
# of observations with 0's recorded	24	51	15	50
# of observations with 1's recorded	81	48	72	22
# of observations 2's recorded	39	31	64	17
# of observations with 3's recorded	4	13	21	12
Data records range from May 10 to October 24, 2014 May - 36 records; June - 27 records; July - 17 records; August - 12 records Sept - 4 records; October - 4 records				

To assess differences, if any, in insect activity from Warm Springs to the mouth of the Deschutes, the survey broke the river into the following six reaches that guides used to describe their location.

1) Warm Springs Bridge boat ramp to Trout Creek boat ramp
2) Trout Creek boat ramp to Whitehorse campground (just above Whitehorse rapid)
3) Whitehorse campground to Harpham boat ramp
4) Harpham boat ramp to Sandy Beach boat ramp
5) Pine Tree boat ramp to Mack's Canyon boat ramp
6) Mack's Canyon boat ramp to the mouth

The larger number of surveys submitted in 2014 makes it possible to look at the results in each of these reaches individually. Table 3 shows that the total number of surveys submitted for each reach varied, as well as the dates from which information was collected (survey dates are shown in "( )" under each reach name). For example, for the reach from Warm Springs Bridge to Trout Creek, eight surveys were submitted within a date range from May 13, to July 29. The most surveys were recorded in the Harpham to Sandy Beach reach (24), closely followed by the Pine Tree to Mack's Canyon reach (22). The fewest were recorded in the Warm Springs Bridge to Trout Creek reach (8), followed by Trout Creek to Whitehorse (11) and Mack's Canyon to the mouth (17). Since the number of surveys recorded in each reach was different, the activity level results are reported as a percent of the number of surveys submitted for that reach. This allows the results to be compared across all the reaches. Because more than one species was assessed within each order, the total percent of adult activity for each order within a reach will add up to more than 100 percent.

Adults of all the orders were observed in all six reaches, but differences between reaches can be seen. For example, mayflies were more prevalent in the middle reaches (Whitehorse rapid to Harpham, and Harpham to Sandy Beach), than in the two upper or two lower reaches. The fewest mayfly adults were seen in the lowest reach from Mack's Canyon to the mouth, which had no mayfly adults observed on 59% of the surveys. The 6% shown as "high" abundance in this section represents just one survey that observed a large number of blue-

winged olive adults (*Baetis* sp.). The highest upstream reach (Warm Springs Bridge to Trout Creek) also showed relatively low numbers of mayflies with no adult activity observed as "high," and 25% of surveys with no adults observed.

TABLE 3. Summary table of River Section hatch abundance.
0 = none observed 1 = low abundance 2 = moderate abundance 3 = high abundance

	Warm Springs to Trout Creek (5-13/7-29)	Trout Creek to Whitehorse (5-18/7-4)	Whitehorse to Harpham (5-20/7-12)	Harpham to Sandy Beach (5-10/10-24)	Pine Tree to Mack's Canyon (5-16/8-30)	Mack's Canyon to Mouth (6-16/10-6)
# of surveys submitted for each reach	8	11	18	24	22	17
Mayfly Abund = 0	25%	0%	6%	25%	18%	59%
Mayfly Abund = 1	75%	109%	89%	121%	50%	35%
Mayfly Abund = 2	38%	64%	56%	25%	50%	0%
Mayfly Abund = 3	0%	0%	6%	4%	5%	6%
Stonefly Abund = 0	75%	9%	39%	58%	32%	88%
Stonefly Abund = 1	0%	73%	50%	50%	73%	12%
Stonefly Abund = 2	38%	91%	44%	21%	23%	0%
Stonefly Abund = 3	25%	36%	17%	0%	9%	0%
Caddisfly Abund = 0	13%	9%	22%	8%	18%	18%
Caddisfly Abund = 1	25%	73%	89%	133%	41%	24%
Caddisfly Abund = 2	38%	45%	83%	38%	50%	65%
Caddisfly Abund = 3	38%	18%	6%	13%	23%	35%
Diptera Abund = 0	63%	27%	61%	54%	45%	47%
Diptera Abund = 1	13%	27%	6%	42%	18%	18%
Diptera Abund = 2	25%	27%	33%	4%	14%	12%
Diptera Abund = 3	0%	18%	0%	4%	18%	29%
Data records range from May 10 to October 24, 2014 May - 36 records; June - 27 records; July - 17 records; August - 12 records Sept - 4 records; October - 4 records						

Note: Because there are individual observations for several species within each order, the total percent of observations within each order is greater than 100%.

Stoneflies were most abundant in the upper two reaches, with "high" numbers of adults seen in 25% to 36% of the surveys from Warm Springs Bridge to Trout Creek and Trout Creek to Whitehorse Rapid, respectively. The lowest three reaches had sparse numbers of stonefly adults reported, especially the lowest reach from Mack's Canyon to the mouth. The low numbers of stoneflies in these reaches are likely, at least in part, due to the earlier emergence of salmonflies and golden stones now occurring on the river due to the increase in water temperature during winter and spring. As a result most of the salmonfly and golden stone adults have already emerged and disappeared by the time surveys began recording data in the lower river sections. This is particularly true for the reach from Mack's Canyon to the mouth, where survey records didn't begin until June 16th. The latest recorded salmonfly or golden stone adult in the upper three reaches was June 3rd.

Caddisflies showed a broad presence from Warm Springs Bridge to the mouth. The greatest percent of "high" abundance was recorded in the upper most reach (38%), but was closely followed by 35% high abundance observed in the lowest reach. The highest percent with no caddis adults observed was 22% in the middle reach - Whitehorse rapid to Harpham. This reach also had the lowest percent of high abundance observed (6%). Because caddis species hatch throughout the season with some of the best historical hatches occurring in June and July, the differences between reaches are less likely the result of shifts in emergence timing, and more likely reflect differences in caddis populations.

The greatest abundance of Diptera adults occurred in the lowest reach, Mack's Canyon to the mouth. This is not surprising since the lower river has warmer water temperatures and possibly greater amounts of algae and fine sediment, conditions that favor Diptera over the other orders of aquatic insects. Diptera were not observed on about fifty percent of the surveys submitted for all reaches, except the Trout Creek to Whitehorse reach for which 27% had no Diptera observed. The high percentage of surveys with no reported Diptera is surprising given the widespread and tolerant nature of Diptera species. It's possible that due to the small size of many Diptera adults, they were overlooked and therefore underreported.

While information about the different insect orders provides a broad picture of insect activity, the activity of specific insects within each order provides a more detailed understanding of changes in adult insect numbers. The following discussion summarizes the results for each of the major hatches within each order.

MAYFLIES (EPHEMEROPTERA)

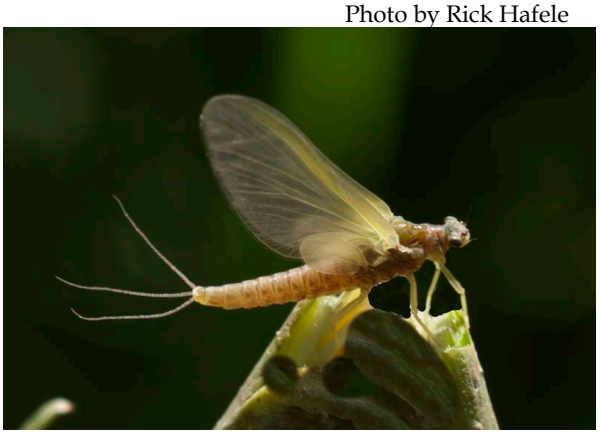
Five major mayfly hatches were listed on the survey forms and are summarized here (Table 4). This is not a complete list of mayflies found in the Deschutes. Some, such as the March Browns (*Rhithrogena morrisoni*), emerge early in the spring before survey records began. As a result, even if March Browns were present they would not be seen during the survey period, and thus were not reported on the survey forms. In addition, the emergence period for different

TABLE 4. Summary table of mayfly hatch abundance.
0 = none observed 1 = low abundance 2 = moderate abundance 3 = high abundance

	Blue-winged Olives	Pale Morning Duns	Pale Evening Duns	Green Drakes	Mahogany Duns
Feeding Guild	Collector/ gatherer	Collector/ gatherer	Scrapers	Scrapers	Collector/ gatherer
Total # of surveys with expected presence	73	80	56	63	44
% of surveys with none recorded	76	35	39	84	75
% with low #'s (1)	11	44	41	8	23
% with moderate #'s (2)	10	20	20	6	2
% with high #'s (3)	3	1	0	2	0
Data records range from May 10 to October 24, 2014 May - 36 records; June - 27 records; July - 17 records; August - 12 records Sept - 4 records; October - 4 records					

mayfly species varies, and does not cover the entire survey period from mid-May to late-October. To account for this, the only surveys used to assess an individual hatch were those taken during their typical emergence period. As a result the number of surveys assessed differs between hatches. That number is shown on Table 4 for each hatch, and ranged from 44 surveys for mahogany duns, up to 80 surveys for pale morning duns (PMDs).

Photo by Rick Hafele



Pale Morning Dun (*Ephemerella excrucians*)

The pale morning dun (*Ephemerella excrucians*) should be one of the most frequent and abundant mayflies on the Deschutes during the survey period, and its hatches can produce some of the best dry fly fishing of the season. Eighty surveys were collected during its typical emergence period. The results found 44% of surveys recorded low abundance, 20% with moderate abundance, and just 1% with high abundance. Thirty-five percent of the surveys found no PMDs during the period they'd be expected to occur. These results suggest that PMD populations are depressed and raises concerns about their health.

Photo by Rick Hafele

Pale Evening Dun (*Heptagenia* sp.)

Pale evening duns (PEDs) (*Heptagenia* sp.) showed similar results, with none recorded on 39% of the surveys, 41% with low abundance, 20% with moderate abundance, and 0% observed with high abundance. Historically PEDs, while not as numerous as PMDs, often occurred in moderate to large numbers in June and July until early August. The lack of any PED adults seen in large numbers raises questions about the condition of their populations.

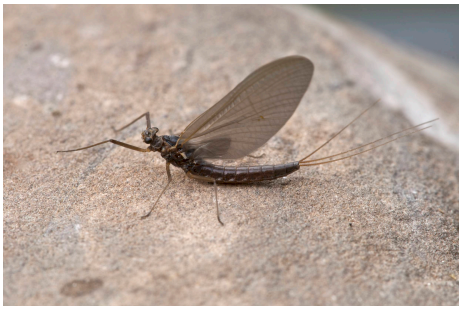
The remaining three mayflies recorded on the surveys - blue-winged olives (*Baetis* sp.), green drakes (*Drunella grandis*), and mahogany duns (*Paraleptophlebia*

sp.) - were all observed in low numbers. Blue-winged olives (BWOs) are some of the most prolific mayflies in streams throughout Oregon and the West, including the Deschutes. Good BWO emergence often occurs in late winter and early spring as well as late fall, outside the window in which the surveys were collected. As a result these surveys don't provide a complete picture for BWO abundance. However, BWO adults were recorded in all six reaches of the river, and in the months of May, July, August, September and October. The results show that no BWOs were seen during the majority of surveys (76%) during those months. Only three percent of the surveys (just two surveys of out 73) saw BWOs in high abundance, with the rest reporting their abundance as low (11%) or moderate (10%).

Photos by Rick Hafele

Blue-winged Olive (*Baetis* sp.)

Green Drake (*Drunella grandis*)



Mahogany Dun (*Paraleptophlebia* sp)

Similar results were observed for green drakes and mahogany duns. Green drakes were observed in sparse numbers in all river reaches except Mack's Canyon to the mouth and Trout Creek to Whitehorse. A high abundance of green drakes was only observed once in the Pine Tree to Mack's Canyon reach. Finally, mahogany duns are a spring and fall hatch on the Deschutes. For these surveys they were recorded from four of the six reaches, with none observed in the upper most reach (Warm Springs Bridge to Trout Creek) or the lowest most reach (Mack's Canyon to the mouth). The majority of surveys found no mahogany duns present (75%) and only one survey recorded moderate numbers (2% of the total). The rest (23%) recorded low numbers present.

While mayflies were observed in all six reaches of the river, large numbers of adults were observed on only four days out of the total number of 100 surveys submitted. This continues the trend of low adult emergence of some of the most important mayfly species on the river.

STONEFLIES (PLECOPTERA)

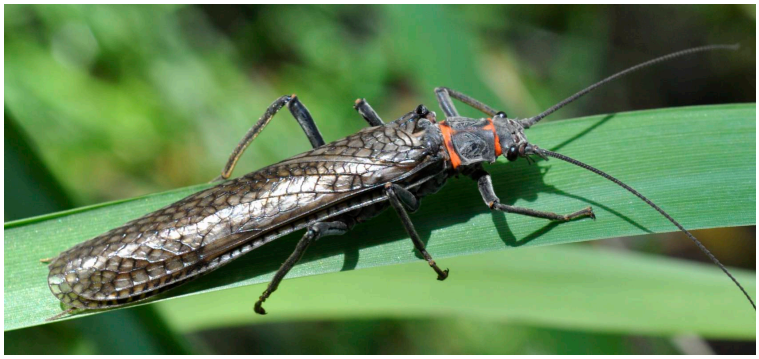
Six groups of stoneflies were covered by the surveys, but results are only shown for four (Table 5). That's because two groups, the spring stone (*Skwala americana*) and the little brown stones (families Nemouridae, Capniidae, and Leuctriidae) primarily emerge as adults outside the period when surveys were collected. In addition the fall stone (*Claassenia sabulosa*), while reported on Table 5, is a short-winged flightless stonefly that emerges from mid-September to late October. Because it is flightless and tends to hide in shoreline vegetation during the day, it commonly goes unseen. As a result the data for this stonefly does not accurately reflect its presence on the river. That leaves three stoneflies with enough information to provide an assessment of their abundance: salmonflies (*Pteronarcys californica*), golden stones (*Hesperoperla pacifica*), and yellow sallies (several species in the family Perlodidae).

TABLE 5. Summary table of stonefly hatch abundance.
0 = none observed 1 = low abundance 2 = moderate abundance 3 = high abundance

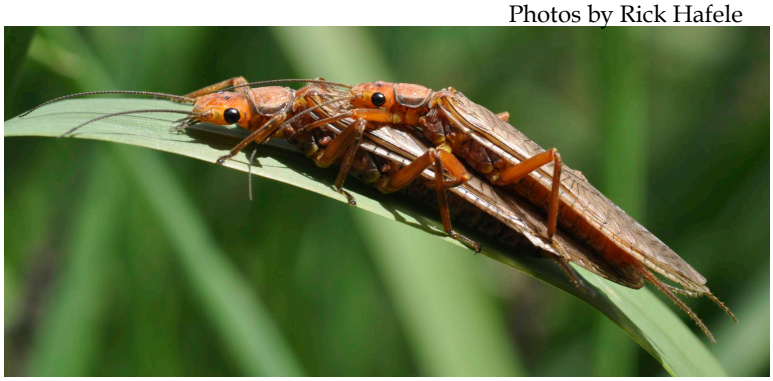
	Salmonfly	**Golden Stone**	**Yellow Sallies**	***Claassenia sabulosa***
Feeding Guild	Shredder	Predator	Predator	Predator
Total # of surveys with expected presence	36	36	63	8
% of surveys with none recorded	41	5	43	99
% with low #'s (1)	25	53	30	1
% with moderate #'s (2)	17	28	24	0
% with high #'s (3)	17	14	3	0
Data records range from May 10 to October 24, 2014 May - 36 records; June - 27 records; July - 17 records; August - 12 records Sept - 4 records; October - 4 records				

Only the May surveys were used to assess salmonfly and golden stone abundance. The reason is that their emergence activity has been starting three to four weeks earlier following SWW implementation than during pre-SWW conditions. Based on 2014's surveys the last observed salmonfly and golden stone adult was June 3rd, in the Whitehorse rapid to Harpham reach. Also, no salmonflies or golden stones were reported in the Mack's Canyon to mouth reach, probably because the first survey in this reach was recorded June 16th, which would be after these stoneflies completed emergence in this section of the river.

Photos by Rick Hafele



Salmonfly (*Pteronarcys californica*)



Golden Stone (*Hesperoperla pacifica*)

Survey results show that golden stones were more prevalent than salmonflies (41% of surveys saw no salmonflies vs. 5% of surveys without golden stones). This may be partly due to differences in emergence timing. While salmonfly and golden stone adults are present at the same time of year, salmonfly adults often start emerging slightly before golden stones. Since the first surveys recorded were collected May 13th, it's possible that salmonfly adults had already begun declining by the time the surveys started. These two species did record the largest percentage of "high" abundance observations of any hatch (17% for salmonflies, and 14% for golden stones). Still, while salmonflies and golden stones were observed in all reaches except the lowest, they were primarily observed in low to moderate numbers.

Yellow sallies is the common name applied to a number of stonefly species in the family Perlodidae. June and July is the historical time of year for peak adult activity of these stoneflies, but based on survey results they appear to be emerging earlier: the first adults were recorded on May 10th in the Harpham to

Sandy Beach reach, and the latest was seen July 7th from one survey in the Mack's Canyon to mouth reach. Thus, in 2014, May and June were the peak months of yellow sally adult activity.

Photo by Rick Hafele

Yellow Sally (family Perlodidae)

Yellow sally adults were seen in all six reaches of the river. They appeared to be most common and abundant in the reach from Pine Tree to Mack's Canyon, but also common in the Whitehorse to Harpham reach and Harpham to Sandy Beach. The Mack's Canyon to mouth reach recorded the fewest number (only observed twice in low numbers). While widespread in the river, the numbers of adults were characterized primarily as low (30% of surveys) or moderate (24%), with just two surveys (3%) out of a potential of 63 described as high abundance. They were not observed in 43% of the surveys from May and June.

CADDISFLIES (TRICHOPTERA)

Caddisflies were the most common order of adults recorded on the surveys with just 15% of the surveys showing no adults present. Six different caddisfly taxon were recorded by the surveys (Table 6). All six were found in all reaches of the river, and two - saddle-case caddis and micro caddis - were recorded during all six months of the survey. The least common caddis was the October caddis (*Dicosmoecus* sp), which was noted on just four surveys: three in the Harpham to Sandy Beach reach and one in the Mack's Canyon to mouth reach. All four noted their numbers as "high" abundance. October caddis, as their name implies, is a late fall hatch usually beginning on the Deschutes in mid September and lasting until late October. Only eight surveys were submitted for September and October, with seven from the Harpham to Sandy Beach reach and

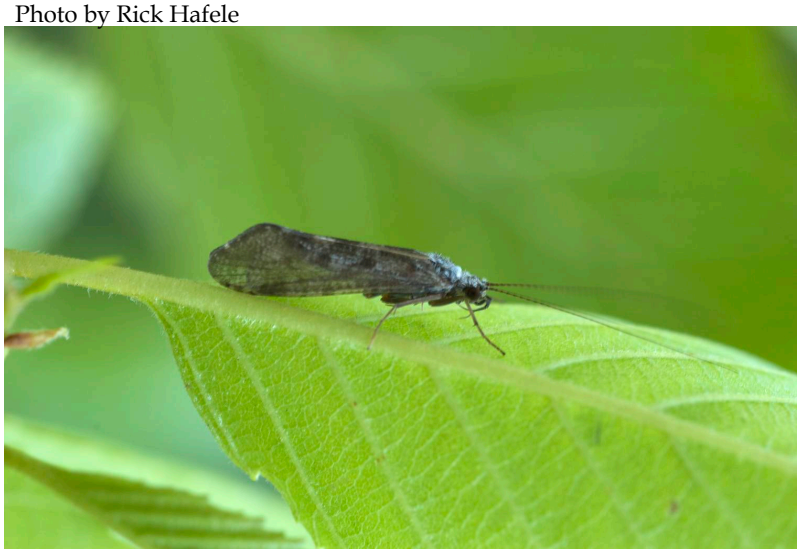
just one from Mack's Canyon to the mouth. As a result the data don't adequately represent the presence of October caddis in the rest of the river.

TABLE 6. Summary table of caddisfly hatch abundance.
0 = none observed 1 = low abundance 2 = moderate abundance 3 = high abundance

	American Grannom	Green Rock Worms	Net-spinning Caddis	Saddle-case Caddis	Micro Caddis	October Caddis
Feeding Guild	Filterer	Predator	Filterer	Scraper	Scraper	Scraper
Total # of surveys with expected presence	44	44	69	100	100	8
% of surveys with none recorded	64	89	25	63	67	50
% with 1's recorded	27	9	32	23	11	0
% with 2's recorded	9	2	30	11	17	0
% with 3's recorded	0	0	13	2	5	50
Data records range from May 10 to October 24, 2014 May - 36 records; June - 27 records; July - 17 records; August - 12 records Sept - 4 records; October - 4 records						

One caddis of particular concern and interest is the net-spinning caddis. This group of caddis is made up of several species in two different genera - *Hydropsyche* and *Cheumatopsyche* - both of the family Hydropsychidae. These caddis have historically produced prolific hatches throughout the summer (primarily June and July) along the entire lower river. It was common for these caddis to approach nuisance levels in the late evening as they swarmed to lay eggs, and just as often swarmed campers' lanterns and ended up adding considerable protein to one's evening meal. Since the completion of the SWW however, such large swarms have been rare if not entirely missing along most of the river.

Photo by Rick Hafele



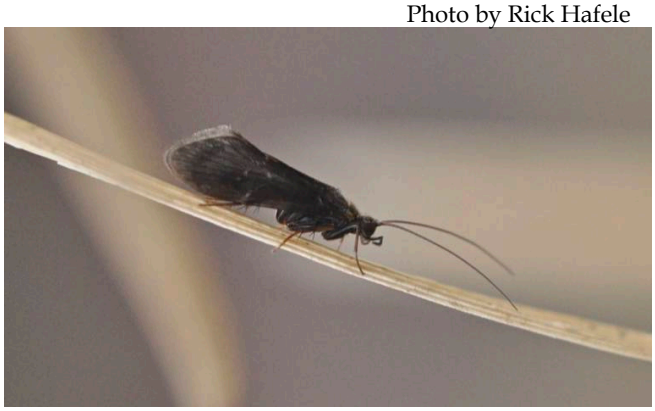
Net-spinning Caddis (*Hydropsyche* sp.)

This year's survey results continue to show a reduced number of net-spinning caddis, even though they were one of the most commonly observed hatches on the river, with just 25% of the expected surveys listing no adults present. The only insect with a lower percentage was the golden stone, with 5% of expected surveys recording no adults present. Second, net-spinning caddis were seen rather equally in all six reaches of the river. Third, they were most common during the summer months with adults observed in 28% of May surveys, 78% of June surveys, 76% of July surveys, and 42% of August surveys. The presence of adults in 28% of the May surveys - the earliest recorded adult was May 19 - suggests emergence may be starting earlier, but the bulk of adult activity was during June and July. Finally, 13% of the surveys recorded adults present in high numbers. While this is the highest of all caddis - except the poorly documented October caddis - it still represents just 9 surveys with high numbers out of 69 surveys submitted during their May, June, July, and August emergence period. Moderate and low numbers of adults were recorded in 30% and 32% of the surveys, respectively (Table 6). Though net-spinning caddis were still widespread during the summer, the results reflect the general lack of large numbers of adults that were once common place.

Saddle-case caddis (*Glossosoma* sp.) are small caddis that often occur in large numbers. Their larval stage scrapes diatoms from the surface of cobble and boulder substrate in moderate to fast riffle habitat. This genus includes several

species, and adults can be abundant in late winter and early spring before survey records began. Survey results, however, found them present throughout the six month survey period and in all six reaches of the river, but not in large numbers. High numbers of adults were reported on just two occasions. The remaining surveys showed low numbers present 23% of the time, moderate numbers present 11%, and no adults seen on 63% of the surveys (Table 6). Because saddle-case caddis feed on diatoms in the same habitat being heavily grown over by stalk-forming diatoms that don't provide suitable food, their populations could easily be impacted.

Photo by Rick Hafele



Saddle-case Caddis (*Glossosoma* sp.)

Micro-caddis (family Hydroptilidae) include a variety of species that emerge over a widespread period with large numbers of adults typically common throughout the summer. They are even smaller than saddle-case caddis, but live in similar habitat and also feed by scraping diatoms from the substrate's surface. Survey results for micro-caddis were very similar to the results of saddle-case caddis. A total of 5% of surveys reported high numbers, 17% moderate numbers, 11% low numbers, and 67% had no adults reported (Table 6). Their small size can make them difficult to see, but adults are quite active during the day and evening, and when abundant they can be a nuisance by flying around your face and swarming around camp lanterns and stoves.

Green rock worms (*Rhyacophila* sp.) and American grannoms (family Brachycentridae) both commonly emerge in the spring and fall, with some emergence occurring before surveys started. Therefore, these survey results don't represent their overall abundance. However, green rock worm adults were only

observed in low to moderate numbers in just a few surveys in June and July (89% of surveys reported no adults). American grannom adults, while more common than green rock worms, were also not observed in high numbers and were absent in 64% of the surveys. These results suggest depressed populations, but more information in the early spring (March & April) is needed to assess their current health.

As previously mentioned, caddisflies represent the most abundant adult aquatic insects of the those recorded on the Deschutes during the survey period. While they were widespread - found in all reaches of the river - and present throughout the survey period, the general lack of large numbers of adults is a worrisome change from past conditions.

DIPTERA

Only two Diptera were reported on the surveys; midges (family Chironomidae), and the small crane fly of the genus *Antocha*. Midges include many different species that live and feed in a wide range of habitats in the river, and often occur in large numbers. However, because of the very small size of larvae and adults, they often go unseen and are easily overlooked. Results for midges show adults were not recorded in 51% of the surveys, but were noted as present in high numbers 12% of the time, and in moderate and low numbers in 17% and 19% of the surveys, respectively (Table 7). Adult midges were also reported in all months surveyed from all river reaches.

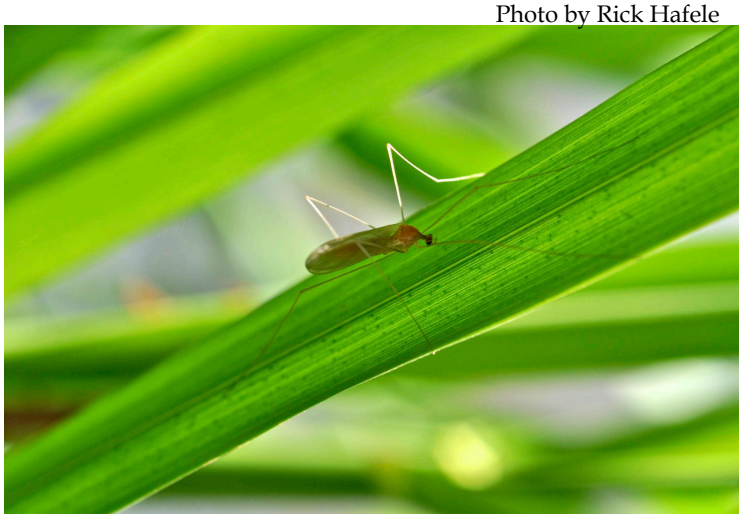
The *Antocha* crane fly continues to show one of the most dramatic declines of any aquatic insect in the river following SWW implementation. In the years before SWW, *Antocha* adults were abundant along the entire lower river from June through August. In 2014, adults were observed in very low numbers on just three occasions; twice in the Harpham to Sandy Beach reach (once May 10, and once July 22), and once in the Mack's Canyon to mouth reach on August 14. This unusual decline indicates that *Antocha* is particularly sensitive to the changes that have occurred in the river. The specific reason for their sensitivity is not known, but *Antocha* lays its eggs in the splash zone of boulders and cobble protruding

TABLE 7. Summary table of Diptera hatch abundance.
0 = none observed 1 = low abundance 2 = moderate abundance 3 = high abundance

	Chironomids	**Crane Flies (*Antocha* sp)**
Feeding Guild	Varied	Collector/gatherer
Total # of surveys with expected presence	100	56
# with none recorded	51	97
# of 1's recorded	19	3
# of 2's recorded	17	0
# of 3's recorded	12	0
Data records range from May 10 to October 24, 2014 May - 36 records; June - 27 records; July - 17 records; August - 12 records Sept - 4 records; October - 4 records		

just above the water's surface. This habitat has been heavily impacted by stalked diatoms, which may be preventing successful egg laying or egg development by *Antocha*. The presence or absence of *Antocha* adults could provide an important and easily observed indicator of future river conditions.

Photo by Rick Hafele



Crane Fly (*Antocha* sp)

SUMMARY

In 2014 Deschutes River guides submitted 100 surveys evaluating the abundance of aquatic adult insects. This was a three fold increase over the number of surveys submitted in 2013, largely due to the use of the online app developed for filling out and submitting the survey. Because of the increased number of surveys, the data in 2014 provides a more complete picture of adult aquatic insect activity through the 2014 fishing season.

The survey divided the lower hundred miles of the Deschutes into six reaches. Adults of the four major orders of aquatic insects (mayflies, stoneflies, caddisflies, and Diptera) were represented in all six reaches and in all months within the survey period; mid-May through the end of October.

As in 2013, the results from 2014 continue to document that aquatic adults are generally not abundant. The hatches with the largest percent of "high" numbers reported were salmonflies (17%) and golden stones (14%), followed by net-spinning caddis (13%) and midges (12%). All of the mayflies reported (e.g. pale morning duns, pale evening duns, blue-winged olives) were rarely if ever seen in high abundance (presence of high numbers ranged from 0-3%). Overall, caddisflies were the most common adults reported, but they were also mostly observed in low to moderate numbers and often not seen at all: depending on the species the percent of surveys without any caddis adults observed ranged from 25-89% (Table 6). The most common caddis was the net-spinning caddis (family Hydropsychidae). This is an iconic hatch on the Deschutes, and though large numbers of adults were observed they occurred on just 9 out of 69 surveys (13%) collected during their emergence period. Other caddis showed much lower abundance.

Another question was, do differences in adult abundance exist along the length of the river from Warm Springs Bridge to the mouth? This was evaluated by breaking the river into six reaches. While the data are limited in some reaches, there were enough surveys in 2014 to look at possible differences between them. Differences were noted, but they were relatively small. Reach differences were most pronounced for stoneflies, which had their highest abundance reported

from the two upper most reaches, and for Diptera, which had their highest abundance observed in the lowest reach, Mack's Canyon to mouth. The remaining hatches show mostly similar results from the upper river to the lower river (Table 3).

Last, as described in the Diptera section, *Antocha* crane flies remain the most impacted aquatic insect on the river. Adults once could be seen throughout the summer along the entire lower river bouncing around streamside vegetation and forming egg-laying swarms around the protruding tops of boulders near shore. Since SWW implementation they have virtually disappeared. In the surveys collected in 2014 just a few adults were seen on only three occasions.

There is no direct evidence that link the low numbers of observed adults to a specific cause. However, changes in the algal community have also been observed since SWW implementation, particularly large populations of two previously unreported species of stalk-forming diatoms. These diatoms appear to negatively impact both habitat and food resources for many of the aquatic insects, including a possible disruption of egg laying habitat for *Antocha* crane flies. These changes in the algal community need to be investigated, as surface water withdrawal at Round Butte Dam could well be causing changes in nutrients levels in the river.

One final observation reported by guides and long-time anglers on the Deschutes that is related to the decline in adult aquatic insects, is the widespread disappearance of insect feeding birds such as swallows and nighthawks, as well as bats. Swallows, for example, were such a common sight from spring through the summer one gave them little thought, and their nests often formed crowded colonies on cliffs near the river. In recent years, however, swallows have become rare enough that one is pleasantly surprised to see a few feeding over the river. The evening call of nighthawks, or the darting flight of bats at dusk, have also become rare events. Such changes show the strong links between the river and the land, and how important the health of the river's aquatic life is to the entire ecosystem.

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