AMPHIBIAN SURVEYS IN YELLOWSTONE NATIONAL PARK

JULY - AUGUST, 2001

Charlotte C. Corkran
NERI Report #01-03

INTRODUCTION

During mid-summer of 2001, I spent three weeks as a volunteer surveying for amphibians in Yellowstone National Park. David Corkran was scout, data recorder, site photographer, and occasional surveyor. Tory and Meredith Taylor were amphibian surveyors and horsepackers for the final week of our work. Our efforts were part of a project to characterize amphibian species distribution and abundance within the Greater Yellowstone Ecosystem (GYE), by surveys to identify breeding sites. Principal investigators are Debra Patla and Dr. Charles Peterson at Idaho State University. The project is part of the U. S. Department of Interior's Amphibian Research and Monitoring Initiative.

STUDY AREAS

Several 7th level watershed units of Yellowstone National Park (YNP) had been randomly selected in 2000. For 2001, we agreed to survey for amphibians in 3 of the units. These were: Unit # 302 – Buffalo Meadows in the Firehole River of the Madison River drainage, Unit # 167 – Duck/Maple Creek in the Madison River drainage, and Unit # 494 – Upper Chipmunk Creek in the Yellowstone River drainage. In addition, we surveyed other wetlands in YNP and on the Bridger-Teton National Forest (B-T NF) during the trip to the Chipmunk Creek unit. The B-T NF surveys are discussed in a separate report.

METHODS

Within each of the selected watershed units, we were requested to visit potential amphibian breeding habitat, as identified by the National Wetland Inventory (NWI). For each of the watershed units we were given a map and list of the NWI wetlands, with notations on which sites not to visit if we did not have sufficient time. Other recognized constraints included access feasibility, safety, and avoiding disturbance to wildlife.

Our protocol for each of the units involved three steps. First, we transcribed the watershed unit boundary and the outlines of all wetlands identified on the NWI map onto the 7.5 minute topographic maps of the area. Second, we studied the topographic maps and all available trail maps, guidebooks, and the YNP Backcountry Trip Planner to determine campsite locations, trail access and distances, and to evaluate the feasibility of cross-country travel routes to reach all of the wetlands. With this information we planned our pack trips and day hikes, secured backcountry permits, and advised appropriate backcountry rangers of our plans. Third, we worked through the watershed unit, visiting one or more wetlands on each day, and completing surveys where potential amphibian breeding habitat was found.

At each potential breeding site, a basic amphibian survey (Thoms et al. 1997) was completed. For distinct ponds, surveyors walked around the entire perimeter and a zigzag course through wide shallow water zones, scooping with a net every five or six steps. For wet meadows, we walked a zigzag course through the area, searching for water pockets where changes in the

vegetation were noticed, and surveying these as we did ponds. For streams running through wet meadows, we walked along one side, brushing a net through the vegetation on the opposite side, and surveying stream pools in the same way we did ponds. For each wetland surveyed, the numbers of larvae, metamorphs, juveniles and adults of each species of amphibian were recorded, along with survey start and end times, weather, habitat data, water temperature, pH and conductivity, and UTM coordinates taken with a GPS unit. A map of each wetland was sketched, and any wetland not shown on the NWI map was plotted on the topographic map of the unit. Photographs were taken of each site, and of the species and life stages found in the watershed unit. Observations of other wildlife, particularly reptiles, were also recorded.

Precautions were taken to reduce the possibility of transferring amphibian diseases or weed seeds. Before travelling to YNP, all amphibian gear had been scrubbed and sterilized with 10% chlorine. Between trips into different watersheds, all gear was scrubbed and all sides dried in direct sunlight for several hours. After exposure to dead frogs found in one location, several items were sterilized with boiling water and direct sunlight.

RESULTS

In 2001, we worked on the project for part or all of 25 days between July 9 and August 6, completing surveys of amphibian habitat on 13 days, and spending part or all of the other days backpacking, horsepacking, coordinating with the principal investigator or Park Service Rangers, and transferring data from field notes to data sheets. Backpacking, horsepacking and cross-country day hiking from backcountry campsites gave us access to wetlands in the three selected units. Several wetlands outside of the selected watersheds were reached by trail and cross-country hiking on the last 3 days of our work.

Unit #302 – Buffalo Meadows

To complete the survey work begun in 2000 in the Buffalo Meadows unit we took a 4-day backpack trip similar to the one last year, working out of the same campsite (0D2) adjacent to the southeast end of the unit. On each day we reached different parts of the unit by either continuing north on the trail and then following a compass course (derived from the topographic map) to each wetland, or hiking cross-country following elk trails parallel to the east side of the creek draining Buffalo Meadows (which we called "Buffalo Fork"). The first 2 days we worked in the southeast portion of the unit, visiting small wetlands that had not been visited in 2000. The 3rd day we spent in the main Buffalo Meadows, re-surveying several ponds and surveying others only briefly visited in 2000. The last morning we re-surveyed one pond in the Little Firehole Meadows part of the unit.

Our surveys occurred on the same dates as last year (July 10-12,'00 and July 11-14, '01). There had been much less precipitation in winter and spring, and many sections of the meadow that were very wet sedge areas last year were dry or only slightly moist. However, all of the ponds we re-surveyed were at the same water level or only slightly lower, except for #10 which was dry. Most of the small wetlands in the southeast part of the unit were also dry, although there were no ponds. These sites appeared to be seasonal forested wetlands, as indicated by the understory vegetation which was dominated by grasses with only occasional elephant's head (*Pedicularis groenlandica*) and ladies' tresses (*Spiranthes romanzoffiana*).

Of the 18 sites we were requested to visit, surveys were completed at 9 sites, 2 sites were visited briefly because they were dry at the time, and 6 sites were searched briefly but found to have no potential amphibian breeding habitat. There was one small wetland near the east edge of the unit that we did not have time to visit.

Three species of amphibians were found in the unit during the surveys: tiger salamander (*Ambystoma tigrinum*), boreal chorus frog (*Pseudacris maculata*), and Columbia spotted frog (*Rana luteiventris*). Larval stages confirming breeding were found at several sites for each species. The priority species, western toad (*Bufo boreas*) and northern leopard frog (*Rana pipiens*), were not found in the unit, nor were any reptiles.

Unit #167 – Duck/Maple Creek

A 5-day backpack trip gave us access to the north fork of Duck Creek, a tributary of Maple Creek. Because the nearest campsites (1C4 and 1C5) are 5 km from the edge of the unit, special permission was obtained from the YNP Backcountry Office to find a place to make camp near the head of the west fork of Winter Creek, about 1 km off of the Mt. Holmes Trail and ¾ km from the north edge of the unit. From the undesignated campsite, we found a good cross-country route over the low divide from Winter Creek into the Duck/Maple Creek unit. The 2nd afternoon was spent scouting with binoculars from the divide and surveying one site. Two long days were spent following topographic features, elk trails, and compass bearings to reach the other wetlands and complete the surveys.

Open meadows in the steeper country near the head of the watershed made an easy travel route through the northeast part of the unit. However, the majority of the unit had little topographic relief and dense stands of heavily fire-damaged lodgepole pine (*Pinus contorta*) forest, which made travel much slower. The stream course we followed to reach the south and central parts of the unit was dry and lacked a defined channel in many sections, although it was shown on the topographic map as a perennial stream. Upland meadows appeared to be drier than normal. On the other hand, 2 sites shown on the map as seasonal (#8 and 11) had plenty of water and were probably both permanent ponds, and the large #2 site, shown as a wetland on the map, contained a very large permanent pond.

We were requested to visit at least 10 of the 17 wetland sites shown on the NWI map. We visited 9 of the sites, including 2 that were "candidates to drop" (# 4 and 9) instead of 3 nearby sites (#5, 6, and 7). We completed surveys at 8 sites, briefly visited one that was dry (#9), and visited another dry pond not shown on the NWI or topographic maps (#101).

Four amphibian species were found in the unit: tiger salamander, western toad, boreal chorus frog, and Columbia spotted frog. Chorus frogs, including larvae and metamorphs, were found at several sites. Tiger salamanders and spotted frogs were each found at one site, with only adults being observed. A juvenile western toad was found at one site, and 12 larvae were found at a different site. No leopard frogs or reptiles were found in the unit.

Unit #494 – Upper Chipmunk Creek

A 7-day horsepack trip gave us access to the upper end of the main branch of Chipmunk Creek from the south, through the Teton Wilderness Area (B-T NF). The YNP Backcountry Office had

given us special permission to stay 4 nights at campsite #6M5, which is about 2 km from the western edge of the unit. On the 2nd afternoon we followed a compass course to survey sites in the west-central part of the unit. On the 3rd day we followed topographic features and elk trails to reach the extreme east end of the unit. From a cliff top vantage point along the way, we were able to view a number of the sites with binoculars. From the east end we surveyed sites, working back west through the unit. On the 4th day we followed topographic features and a compass course to reach the northwest part of the unit, where we completed the surveys.

The headwaters of Chipmunk Creek are in a mosaic of meadows and forest patches. However, large sections of the drainage are extensive stands of large diameter lodgepole pine that were burned in the 1988 fires. These areas now have numerous large logs with many side branches, which make cross-country travel arduous and slow. We were fortunate to find elk trails along the cliff top through the south portion of the unit. The topographic map was generally accurate with perennial streams and wetlands. It did seem that the NWI map for this unit had been drawn with different standards for wetlands than those of other units we have worked on. Several sites (particularly #12 and 14) were large areas of upland forest or upland meadow with scattered trees. These did include small benches of wet meadow or patches of seasonally moist forest, which we would have expected to be mapped as separate small sites. One site (#5, which was a portion of a very extensive NWI wetland) was a burned forested hillside, with no wetland vegetation seen from either the top or the bottom.

We were requested to visit at least 16 of more than 20 sites on the NWI map. We completed surveys, or made brief visits and found no potential amphibian breeding habitat, at 14 sites. Three other sites were scanned with binoculars from the cliff top near the south edge of the unit. We looked straight down onto #8, but only viewed #19 and 20 from 1½ and 2 km respectively. We may also have seen #13 from this viewpoint, and we did walk through it but apparently thought it was another dry part of #12, which we mistakenly thought extended north of the creek at that point (had there been any potential breeding habitat we would have seen it). An unmapped pond (#101) was found between sites #6 and 7, but it was dry.

Only 2 species of amphibians were found in the unit: boreal chorus frog and Columbia spotted frog. No larvae or metamorphs were seen, but we did find several juvenile spotted frogs that were probably yearlings. No reptiles were seen in the unit.

Other sites on the Two Ocean Plateau

During the trip to survey the Upper Chipmunk Creek Unit we were also able to visit sites in several other drainages. On the 2nd afternoon we traversed 2 wetlands in the south fork of Chipmunk Creek, and re-visited one of these on the 4th afternoon. We took a hike on the 5th day spending most of the day along the Continental Divide, surveying sites at the heads of the south fork of Chipmunk Creek, Crooked Creek, and Plateau Creek.

In the lower part of the south fork of Chipmunk Creek, we found Columbia spotted frog adults at both sites visited. Neither site was fully surveyed. Meredith Taylor found 2 dead adult spotted frogs at Site B, and 2 more when she re-visited the site 2 days later. Three of these frogs were collected. Two other live adult spotted frogs seen on the first visit appeared to be healthy. At

the head of this drainage, boreal chorus frog adults were found at 3 of the 4 ponds visited (the other was dry), and 2 of the ponds had larvae and metamorphs.

At the head of Crooked Creek, we visited 7 ponds, of which 3 were dry. Two of the ponds had boreal chorus frog metamorphs. One of these also had an adult and several larvae. We did not find any amphibians at the other 2 ponds.

Three ponds were visited at the head of Plateau Creek, although several other segments of the dry channel probably formed ponds in a wet year, but were not looked at except from a distance. We found no amphibians in the 2 larger ponds, but found a large number of boreal chorus frog larvae and metamorphs in a small pond that was drying.

DISCUSSION

The 2001 winter and spring were exceptionally dry, and amphibian breeding sites that are shallow may never have received enough water to be available this year. However, periodic summer rains maintained some ponds that probably otherwise would have dried up, stranding developing larvae.

The Buffalo Meadows unit was found again to be very productive of all 3 of the commonly occurring amphibian species. Many ponds were at or near the same water level as last year, which may indicate seeps or springs that maintain them. Large numbers of adult spotted frogs were seen at certain ponds in the main meadow, perhaps spatially restricted by drying of streams or other parts of the unit. Survey results from our return to the unit suggest that many amphibians traditionally breed in the ponds that are permanent or that last long enough for larvae to reach metamorphosis, rather than using ponds that may be warmer or more productive of food but that are ephemeral. It would be interesting to see if the same ponds are selected in a wet year that were used in the 2 dry years. There remain several wetlands that have not been visited, scattered in the north and west edges of the unit, but including one on the east edge that we did not have time to reach. These are all very small and were probably dry at the time of the survey, however they could provide amphibian breeding habitat in a wet year. This unit probably has been adequately covered now.

The Duck/Maple Creek unit was somewhat enigmatic. While 4 amphibian species were found, breeding was confirmed for only 2, and only the chorus frog was widespread. Tiger salamanders were found at a single pond, and spotted frogs were limited to 2 adults at one pond, with no evidence of breeding by either species, although habitat appeared to be appropriate for either or both at 4 or 5 sites. Perhaps the apparent lack of perennial streams and paucity of springs limit the summer or overwintering habitat requirements for these species, or the distances overland may be too great for dispersal into the watershed from other occupied areas. Western toads were found breeding at one pond, but only 12 larvae were found, and it did not appear that others had already metamorphosed and left the water. The possibility that toad eggs or larvae had died remains a subject of concern. Although we completed about all that was requested, we may well have missed some breeding habitat by not visiting the other sites, particularly #1, 10, and 14. To reach these sites would have necessitated at least another day, or a second trip into the area (a possibility for a future year).

The Upper Chipmunk Creek unit was not at all productive for amphibians; indeed we did not find a single breeding site. There was suitable breeding habitat in a number of sites, but it was restricted to small pockets that were dry at the time of the surveys, except for the 2 large ponds at the east end of the unit (#15 and 16). Possible reasons for these 2 ponds not having larvae of any amphibian species are that they are in the pass where they are quite exposed to the wind which may impede the growth of emergent vegetation (possibly by blowing ice around the pond margins as it is breaking up in the spring), or they may be in areas of heavy snowdrift which melts late. We at least briefly looked at all of the sites as requested. We should have made a greater effort to reach #20, because it is shown as a wetland on the topographic map, and may have included a pond (although it was dry at the time of the surveys). That would have been a likely source of the juvenile spotted frogs seen at #12, although the small lake (not surveyed) in the south fork of Chipmunk Creek may be the main breeding site for that species in the region. Having 4 surveyors at Upper Chipmunk Creek made it possible to cover some large sites efficiently in the 2½ days we spent on the unit, leaving us time to explore more of the area. This unit probably has been adequately covered.

The plateau south of the unit was very productive of the single species, chorus frog. Perhaps we should have concentrated our extra time in one of the watersheds. It would be very interesting to explore this region further.

RECOMMENDATIONS:

1. There are several codes used for delineating different wetland types on the NWI maps. I recommend finding those descriptions, and selecting only those types most likely to include amphibian breeding habitat. This would improve efficiency in planning which sites to survey.
2. It would be helpful for backpacking if a light-weight and non-spillable way to preserve and carry dead and diseased amphibians could be found. Would "dry-packs" work?
3. Personally, I am particularly concerned about the current status of the western toad populations in GYE, and would like to see more survey effort spent on that species.

Acknowledgements: Dave Corkran's skillful route-finding and compass acumen were the key to our successful surveys, and his persistence with recording data and photographing sites were also exceptional. Tory and Meredith Taylor were both extremely observant, patient at negotiating difficult blowdown, and dedicated participants in long days of surveys, not to mention excellent horsepackers. Debra Patla's planning and coordination were invaluable in making the most efficient use of our time and efforts, and I am very grateful to her for obtaining maps for us and arranging for reimbursement of some of our expenses. I also appreciated the interest and support of the Park Service, particularly Anita Varley who made helpful suggestions on our route into Duck/Maple Creek, and who permitted us great latitude in finding an appropriate undesignated campsite. The Sierra Club Foundation's generous grant made possible our unforgettable trip to Chipmunk Creek and the Two Ocean Plateau.

LITERATURE CITED

Thoms, C., C. C. Corkran, and D. H. Olson. 1997. Basic amphibian survey for inventory and monitoring in lentic habitats. *In*: D. H. Olson, W. P. Leonard, and R. B. Bury, editors. *Sampling Amphibians in Lentic Habitats: Methods and Approaches for the Pacific*

Northwest. Olympia, WA: Society for Northwestern Vertebrate Biology, Northwest Fauna #4. pp 35-46.

ATTACHMENTS

Forms:

- Work Log
- Sites lacking potential amphibian breeding habitat
- Observations of amphibians en route to survey sites

Annotated topo. maps – 7 (2 are copies of parts of maps)
Survey Data Sheets – 46 (Unit #302 – 11, Unit #167 – 11, Unit #494 – 13, others – 11)
Photographic slides – 105 (Unit #302 – 21, Unit #167 – 29, Unit #494 – 32, others – 23)
Copy of field notes

QUESTIONS & SUGGESTIONS ON ARMI/GYE FORMS:

General comments that apply to all forms:

1. There is inconsistency between forms and confusion in what is requested for the name and/or number of the watershed, and whether or not the watershed is the ARMI unit or a greater basin. On the Survey Data Sheet, the Site Number includes the watershed number as the prefix, but the next line requests the Watershed code or name. Wouldn't the code be the unit number? Is the subwatershed the ARMI unit? Is the "name for the main drainage" the name of the ARMI unit or the name of the major stream into which the ARMI unit drains? Using Unit #302 as an example, the name of the unit has been Buffalo Mdws., but the only stream through it is unnamed, or could be called "Buffalo Fork," or the main drainage could be the Little Firehole River into which the "Buffalo Fork" flows. I suggest that Site Number be called Unit-Site Number, and that Watershed code or name be called Unit Name. Instructions for Locality should also request the main river basin or whatever level is most useful (and give several examples). On the Work Log the Watershed Name is requested, and probably refers to the ARMI unit name, so it should be called Unit Name. The Sites Lacking form requests Watershed and Unit Number. Probably these should be Unit Name and Unit-Site Number. The Observations Enroute form requests Watershed unit if app. and might be better as Unit Name (or Unit Number) if App.
2. I think that Work Log, Sites Lacking, and Observations Enroute all need a space at the very top beside the form name for Observer, and a space for Year up there also.

Survey Data Sheet:

3. Site Origin is a great addition and valuable information, however it is really 2 separate things. One is the origin of the landform or catchment basin, and the other is the origin of the water in the pond or wetland. A glacier may have scoured out the bowl in the rocks, but unless the glacier is still melting into the pond the source of the water could be annual snowmelt or flooding from a stream or whatever. Perhaps you could have Site Origin (all the ones you have, except take out snowmelt and maybe add wallow), and Water Source (snowmelt, flooding, spring/seep). One of these categories could be placed on the form in Site Description instead of the Notes section.
4. Rank emergent veg. is also excellent. Just a question: does fine rushes refer to the spikerushes that are about 5 cm tall, or to the juncus that are more like 30 cm tall, or both?
5. In Life stages, what would you do with a neotenic AMTI? I'm not sure I'd know for certain if a large larva was sexually mature or not, come to think of it.

Work Log:

6. Figuring out whether you surveyed or just visited a site ought to be pretty straightforward. However, the distinction gets pretty blurry when you spend a lot of time wandering around a site to see if there's any part of it that might have amphibians. If there's no potential amphib. breeding habitat you just write it up on the sites Lacking form, so that's probably a no survey, even if it took you an hour to determine that. But if it's a dry site just for now that does have potential amphibian habitat, then you should fill out a survey form (except water data). So is that a survey? Maybe instead of "No. of wetlands visited – no survey (dry)" it should be called "No. of no-habitat sites visited." The number in the no-habitat column should correspond to the number of sites on the Sites Lacking form, and the number in the sites surveyed should correspond to the number of survey forms.

AMPHIBIAN SURVEYS IN THE BRIDGER-TETON NATIONAL FOREST
AUGUST, 2001

Charlotte C. Corkran

INTRODUCTION

During mid-summer of 2001, I spent three weeks as a volunteer surveying for amphibians in the Greater Yellowstone Ecosystem (GYE). David Corkran was scout, data recorder, site photographer, and occasional surveyor. Tory and Meredith Taylor were amphibian surveyors and horsepackers for the final week. The majority of our work was in Yellowstone National Park (YNP), however we did several reconnaissance surveys in the Teton Wilderness Area (TWA) of the Bridger-Teton National Forest (B-T NF). Our efforts were part of a project to characterize amphibian species distribution and abundance within the GYE, by surveys to identify breeding sites. Principal investigators are Debra Patla and Dr. Charles Peterson at Idaho State University. The project is part of the U. S. Department of Interior's Amphibian Research and Monitoring Initiative (ARMI).

STUDY AREA AND METHODS

For the ARMI project, several 7th level watershed units of YNP had been randomly selected in 2000. One of these units that we agreed to survey in 2001 is south of Yellowstone Lake and was most easily reached through the TWA. At the start of a 7-day horsepack trip, our route from the Pacific Creek Trailhead followed Pacific Creek and Gravel Creek, and passed close to several ponds and other wetlands. On our return at the end of the week, we were able to briefly survey 5 sites adjacent to the Gravel Creek Trail in the Gravel Creek drainage (see attached map). The surveys occurred on August 5 and 6. Our surveys in YNP are discussed in a separate report.

Due to time and other constraints, we were only able to survey 2 sites and parts of 3 others. We could not complete a basic amphibian survey (Thoms et al. 1997), but instead did a brief visual survey by walking around the perimeter of each pond. For each site surveyed, the numbers of larvae, metamorphs, juveniles and adults of each species of amphibian were recorded, along with some weather and habitat data (see attached data sheets). Water temperature, pH, conductivity, and UTM coordinates taken with a GPS unit were recorded for one site (the gear being packed on the horses at the time of the other surveys). A map of each wetland was sketched, and the sites were plotted on the topographic map of the area (the Gravel Peak 7.5-minute quadrangle). Photographs were taken of 4 of the sites, and of the species and some of the life stages found (included with this report). Observations of other wildlife were also recorded.

Precautions were taken to reduce the possibility of transferring amphibian diseases or weed seeds. Before travelling to YNP, all amphibian gear had been scrubbed and sterilized with 10% chlorine. Before this horsepack trip all gear was scrubbed and all sides dried in direct sunlight for several hours. We did not use nets or wading boots in the Gravel Creek drainage, partly because they had not been sterilized after being used in another drainage surveyed earlier on the trip.

RESULTS

Three species of amphibians were found during our brief surveys. Columbia spotted frogs (*Rana luteiventris*) were found at every site surveyed. These included mostly adults, but metamorphs (juveniles that had just metamorphosed from the tadpole stage) were also found at 2 sites, confirming breeding by this species at those sites. Boreal chorus frogs (*Pseudacris maculata*) were found at 2 sites, including both adults and metamorphs. A western toad (*Bufo boreas*) was found at one site. It was an immature or small adult, and could have traveled overland for some distance from its natal site, so we did not confirm a toad breeding site.

No reptiles were found on the trip. Several bird species were noted at the wetlands, including green-winged teal (*Anas crecca*), Barrow's goldeneye (*Bucephala islandica*), sora (*Porzana carolina*), sandhill crane (*Grus canadensis*), and spotted sandpiper (*Actitis macularia*). Mammals seen or noted by tracks and scat at the wetlands included muskrat (*Ondatra zibethicus*), wolf (*Canis lupus*), and grizzly bear (*Ursus arctos*).

DISCUSSION

The Gravel Creek drainage has a number of ponds and other wetlands. We were only able to explore briefly a very few sites. The exceptionally dry winter and spring, and the late dates of our surveys, could have prevented our finding larvae or even metamorphs remaining at breeding sites. Despite these potential problems we were able to document breeding sites of 2 amphibian species, and the presence of a 3rd species in this drainage. Additional surveys, earlier in the summer and covering a much broader area, are highly recommended.

I very much appreciate the exceptional teamwork and perseverance of Dave Corkran, Tory and Meredith Taylor. The Sierra Club Foundation's generous grant made possible our unforgettable trip to the Teton Wilderness Area and the Two Ocean Plateau of Yellowstone National Park.

LITERATURE CITED

Thoms, C., C. C. Corkran, and D. H. Olson. 1997. Basic amphibian survey for inventory and monitoring in lentic habitats. *In*: D. H. Olson, W. P. Leonard, and R. B. Bury, editors. *Sampling Amphibians in Lentic Habitats: Methods and Approaches for the Pacific Northwest*. Olympia, WA: Society for Northwestern Vertebrate Biology, Northwest Fauna #4. pp 35-46.

ATTACHMENTS

Annotated copy of part of topo. map
Survey Data Sheets – 5
Photographic slides – 6 from Gravel Creek in the TWA, 3 from YNP