Stymied Steelhead
by Sandy Guldman

A postcard dating from about 1900 promotes the Ross Valley for fishing.

Abundant steelhead trout (*Oncorhynchus mykiss*) and coho salmon (*Oncorhynchus kisutch*) spawned in the creeks of the Ross Valley during the 1940s and 50s. Over the years, these creeks were degraded as fish habitat by hardened banks, culverts, and dams for swimming holes and stock ponds. Fewer and fewer fish returned to spawn. The final insult was the construction of the concrete channel in Kentfield and Ross, built by the US Army Corps of Engineers (USACE) in the 1960s with the intended purpose of reducing flooding. Making it through that barrier is something only the most robust fish can accomplish. About 10 years after its construction, coho salmon were extirpated from the watershed. A very small population of steelhead trout, now listed as threatened under the Federal Endangered Species Act, lingers on.

The section of concrete channel upstream of the College of Marin campus is the primary barrier to fish passage within lower Corte Madera Creek. Although two streams that historically supported salmonid species, Larkspur Creek and Tamalpais Creek, can be reached without passing through the concrete channel, both of them are seriously impaired: neither supports coho or steelhead populations.

Two features to aid migrating upstream of the College of Marin campus is the primary barrier to fish passage within lower Corte Madera Creek. Although two streams that historically supported salmonid species, Larkspur Creek and Tamalpais Creek, can be reached without passing through the concrete channel, both of them are seriously impaired: neither supports coho or steelhead populations.

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beach, Point San Quentin Beach.

Taking a walk, and taking in the views, are the two most popular activities we have been relying on to get us through the days. “What would we do without the Creekside walking path?” writes Laura. “I’ve never seen it so busy. At any given time, there are families on bikes, couples holding hands, parents pushing strollers, runners with head-phones on, skateboarders, dog walkers.” Many other paths in the watershed also provide a nice, easy stroll, like the Larkspur-Corte Madera Path, or those around Shorebird Marsh.

Bird-watching is a reward for many who use these paths. Ann relishes “the ever-changing panorama of bird life,” of Shorebird Marsh. “Flocks of pelicans in late winter, numerous ducks, sandpipers, egrets, an occasional stately great blue heron, and more.” Laura continues, on the Creekside marshes, “black-necked stilts are always there, and often killdeer, mallard pairs, avocets, herons—large and small, white and blue. Gulls and geese, sometimes sanderlings. Even an occasional bufflehead.”

Yet others like to take the steeper path, and get some more strenuous exercise. As Mike says, “Baldy is remarkable, a prominent Marin peak (elev. 1,141’) that sits in the middle of the Corte Madera Creek watershed. It allows views of the headwaters, the slopes of Tamalpais, west to the outer reaches of Fairfax, and of the whole of Ross Valley.” Mike continues, “a steep climb by any route, it gets your heart pumping. And then, at the summit, your spirits are raised with wildflower displays, the sights of the north bay and the City of San Francisco.”

Speaking of adventure, some like to just go outside to be in nature, see the world outside their home. “It is all an adventure to my twin grandsons,” say Charlie. “Buzzing grasshoppers, newts, yellow carpets of tarplant, fragrant sagebrush, rope swings hung from an oak tree, and the scramble up to the water tank on Camino de Herrera, where we cut agave leaves from which to make string. There we look out over the jumble of wooded hills around Fairfax, and up to the skyline of Bolinas Ridge and Mount Tamalpais.”

We are all appreciative of the open space, and diverse habitats—woodlands, chaparral, grasslands—providing for the watershed’s plant and animals. Charlie continues, “We’re often reminded that open space is not far away. Deer trim our roses, browse on maidenhair fern at the open front door, or nibble mock-orange leaves. At night, coyotes’ other-worldly calls and responses tell that the predators have left their dens and are roaming the watershed.” As for the two grandsons, they “didn’t encounter any wolves, fierce or friendly,” on their adventure, but they did get to “watch two coyotes slinking away under some Italian stone pines in Hawthorne Canyon.”

Others took to relaxation. Gerhard

Continued on Page 7
In an out-of-the-way corner of Ross, the Basketry Garden lies on an eastern slope of the Marin Art and Garden Center, with a view to lofty Bald Hill. It covers about half an acre adjacent to the Barn Theater, and features over seventy species of plants—most of them Californian natives—traditionally used in basketry or cordage-making. Woven fences, big baskets, and basket bee-hives (skeps) punctuate this semi-wild area.

The garden is intended to display a variety of plants used by Native basket weavers, demonstrate traditional cultivation and harvesting practices, and to be a minor source of basketry materials. It also attracts hummingbirds, juncos, phoebes, and many other birds and insects. Red-shouldered and red-tailed hawks are often wheeling overhead.

I was inspired to create this garden by the discovery of a patch of whiteroot sedge (Carex barbarae), a grass-like plant used by the Pomo and other central Californian tribes in making extremely fine basketry. This small patch was hemmed in by thistles, dense broom and, on the downhill side, Bermuda grass stretched down to the gravel parking lot. A MAGC gardener at the time used the area as an orphanage for unwanted specimen plants. Beginning in 2004, as a volunteer, I pulled, dug, or smothered undesirable plants and replaced them with fiber plants that I propagated, begged for, or bought.

From the small patch of sedge, plants were propagated to fill a large area of the garden. In designated beds, the heavy soil has been amended with large quantities of sand and of chippings from tree services, and every two years each bed is cleared of plants and the underground rhizomes. The hundreds of removed plants are donated to STRAW for creek restoration on Lagunitas Creek, while many of the rhizomes—a prized weaving material up to six feet long—are given to Native and non-Native weavers.

Other prominent basketry plants are seven species of willow, coppiced or pollarded (i.e., cut above deer grazing height) annually to produce long shoots. The native grey willows (Salix exigua) growing here are clones from the last tree of the species growing in the Ross Valley, on Lagunitas Road. The mother tree died in about 2005, and I have planted cuttings at several locations in the valley. Marsh plants grow in and around a group of water tubs: two species of tule, common reed, three-square (Schoenoplectus americanus), river bulrush (Bolboschoenus fluviatilis), and several species of Juncus. Deer grass, looking like 3-feet-high fountains, has flowering stems that are used for the foundation of coiled baskets. Redbud and creek dogwood have reddish stems and attractive flowers. Dogbane, milkweeds and lemon-root (Hoita macrostachya) are used for string-making. There is also a section reserved for conifers, and one for desert plants used in basketry.

Each plant used for basketry or string-making has an optimum time for gathering, relating to its growth stage or benefit to the plant’s growth or for pest control. So, redbud—valued for its reddish bark—is cut in winter when the bark adheres to the wood, whereas grey willow is typically cut in late February when the bark can be slipped off and discarded. After gathering, plants are processed to a stage convenient for storing and seasoning, and only later, trimmed for use.

As a basket-weaver interested in many different kinds of traditional techniques from around the world, I use many of the fiber plants in the garden, and also provide them to my students.

The Basketry Garden, as a part of MAGC, is open and free to visitors at all times, although, as of this writing, the parking lots are closed to cars. A plant list and map are available by request to charleskennard@comcast.net.
salmonids were included in the design. The 33-foot-wide concrete channel has a v-shaped bottom that provides a low-flow zone for fish, and the upper part of the channel includes small depressions, intended to serve as resting “pools” for fish during higher flows.

In 1972, a wooden bulkhead, about five tall, was built at the upstream end of the concrete channel as a “temporary” structure to prevent erosion upstream. The bulkhead includes a wooden Denil fish ladder intended to facilitate fish passage. Although the USACE had planned to continue the concrete channel through Ross, local opposition stopped construction. The bulkhead and Denil fish ladder were originally intended to be in service for only one season; unfortunately, their flood-damaged remnants are still in place, about 50 years later.

With a grant from the National Fish and Wildlife Foundation, Friends hired Michael Love & Associates and Jeff Anderson and Associates (MLA-JAA) to conduct a detailed passage assessment for steelhead in the upper part of the concrete channel. The Marin County Flood Control and Water Conservation District and the USACE made in-kind contributions.

As part of this effort, volunteers with Friends, directed by MLA-JAA, made videos at several locations during the fall of 2005 and winter of 2006. The videos showed what appeared to be a Chinook salmon (likely a stray from the Sacramento River system) in early December attempting to pass through the Denil fish ladder. Two steelhead were attempting to enter the fish ladder and one was resting in one of the resting pools in the concrete channel.

In addition to these four salmonids observed in 2005-2006, several steelhead kelts (fish that had spawned and were returning to the ocean) were observed together in a pool immediately upstream of the fish ladder in February 2006, reluctant to move down the ladder. These sightings confirmed that steelhead can occasionally ascend the Denil fish ladder.

The assessment (MLA-JAA 2007) used detailed modeling that covered variable water depths and velocities and how far fish can swim before becoming exhausted. Passage conditions were evaluated for six flows from 14 cfs (cubic feet per second) to 177 cfs. Each flow was analyzed for three tidal conditions: mean low water (MLLW), mean tide level (MTL), and mean high high water (MHHW). The table above shows the results from the channel modeling.

<table>
<thead>
<tr>
<th>Tide</th>
<th>14 cfs</th>
<th>23 cfs</th>
<th>40 cfs</th>
<th>77 cfs</th>
<th>113 cfs</th>
<th>177 cfs</th>
</tr>
</thead>
<tbody>
<tr>
<td>MLLW</td>
<td>7</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>MTL</td>
<td>98</td>
<td>85</td>
<td>51</td>
<td>13</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>MHHW</td>
<td>99</td>
<td>92</td>
<td>97</td>
<td>73</td>
<td>54</td>
<td>4</td>
</tr>
</tbody>
</table>

Generally, satisfactory fish passage means that more than 90–95% of fish can move through the area during flows considered appropriate for spawning. The assessment found that during most of this period the proportion of fish able to pass through the concrete channel ranges from low to negligible. Because the lower portion of the concrete channel does not include any resting pools, at low tide nearly all the fish become exhausted attempting to swim through this lower reach.

Even for the fish who succeed in swimming the length of the concrete channel, the fish ladder at the bulkhead lacks an entrance pool downstream, so steelhead struggle to swim through a fast and shallow jet of water just to reach the entrance. The fish ladder often catches debris, creating yet another barrier to fish trying to reach upstream spawning grounds.

**Are There Solutions?** As part of their 2007 study, MLA-JAA also evaluated the use of new larger resting pools to improve passage success within the concrete channel. The analysis focused on three different pool shapes, to identify a configuration that would provide low velocity zones suitable for steelhead to rest at all fish passage flows. An additional objective was to develop a pool shape that would minimize sedimentation. They developed three designs, with one better for straight reaches of the channel and another in curved reaches. Now, an additional complication has been added: more water needs to be accommodated in the concrete channel to reduce flooding. Unfortunately, features to aid fish passage often reduce the channel’s water capacity.

MLA and consultants working with the Flood Control District on the project, are designing measures to meet all three objectives. Alternatives being evaluated include:

- installing much larger pools in the bottom of the channel;
- total or partial removal of the concrete channel upstream of the Kentfield Rehabilitation Hospital;
- raising channel walls;
- lowering part of the channel, and/or
- installing set-back walls.

One size does not fit all. Each section of the creek requires a different combination of measures. But whatever project is implemented, it will include removal of the bulkhead and fish ladder. There are alternative means to handle the elevation change between the bottom of the concrete channel and the natural creek bottom upstream of the bulkhead.

The Flood Control District has begun preparation of an Environmental Impact Report (EIR) that will cover proposed changes to the concrete channel. The public scoping meeting for the EIR is tentatively scheduled for August 2020. Check the Ross Valley Watershed website for more information as work proceeds. We are confident that a project that meets with public approval will be developed and that it will include improvements to fish passage—everyone can agree on that.
All animals and insects need oxygen to live and they acquire it in a variety of ways. They use it to convert nutrients into the energy they all need for life itself. Getting this oxygen is easy for terrestrial creatures, including humans. The air that surrounds us contains abundant oxygen (about 20% is oxygen) and we are well adapted for extracting what we need.

Getting essential oxygen is much harder for fish. Oxygen is not very soluble in water and fish can only access dissolved oxygen (DO). Worse, as temperatures rise, oxygen solubility goes down and fish requirements for it go up. DO is always an important factor in aquatic habitat quality for fish and in summer, when temperatures rise, it can become the critical factor in determining fish survival.

How does oxygen get into the water? Oxygen enters water from air or as a by-product. From the air, oxygen slowly diffuses through the water surface or is mixed in quickly through aeration. DO is also a by-product of photosynthesis from aquatic plants. As a result, DO levels can fall at night, when there is no photosynthesis, and rise during the day. Winds contribute to DO by aerating the water when they blow over it. Waterfalls and riffles also aerate water. Abundant, well-aerated groundwater inputs can both cool the water and directly contribute more DO.

Why measure dissolved oxygen? We measure DO because it is so critical to the health, and the very survival, of fish. We measure DO as milligrams per liter (mg/L). DO levels and how they vary throughout the day are important in monitoring environmental quality and determining needed management actions. DO requirements vary with fish species, stage of development, temperatures at which prior acclimation occurred, and activity level. As noted above, DO levels and fish metabolic rates both depend on temperature: as temperature increases, the saturation level of DO in the water decreases, but fish become more active and their DO requirements increase. The table below summarizes information about steelhead trout in our watershed.

In general, salmonids incubated at low DO levels are small with slower development, are weak, and abnormal.

<table>
<thead>
<tr>
<th>Life Stage</th>
<th>Optimal Water Temperature</th>
<th>Dissolved Oxygen (mg/L)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Immigration, Spawning, and Incubation</td>
<td>7.8 – 11.2 °C</td>
<td>≥7 below 15°C</td>
<td>≥7 below 15°C</td>
</tr>
<tr>
<td></td>
<td>46.0 – 52.0 °F</td>
<td>≥9 at or above 15°C</td>
<td></td>
</tr>
<tr>
<td>Fry Emergence</td>
<td>8.9 – 11.2 °C</td>
<td>≥7 below 15°C</td>
<td>≥7 below 15°C</td>
</tr>
<tr>
<td></td>
<td>48.0 – 52.0 °F</td>
<td>≥9 at or above 15°C</td>
<td></td>
</tr>
<tr>
<td>Rearing</td>
<td>12.8 – 15.6 °C</td>
<td>≥7 below 15°C</td>
<td>≥7 below 15°C</td>
</tr>
<tr>
<td></td>
<td>55.0 – 60.1 °F</td>
<td>≥9 at or above 15°C</td>
<td></td>
</tr>
<tr>
<td>Smoltification, Emigration</td>
<td>6.98 – 11.3 °C</td>
<td>≥7 below 15°C</td>
<td>≥7 below 15°C</td>
</tr>
<tr>
<td></td>
<td>44.4 – 52.3 °F</td>
<td>≥9 at or above 15°C</td>
<td></td>
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</tbody>
</table>

Dissolved Oxygen
In Ross Creek
Continued from Page 5

Structures such as this log, installed in Ross Creek, do triple duty: provide shelter for fish, protect the creek bank from erosion, and are convenient places to attach temperature gauges. Photo by Sandy Guldman

Structural growth is more common. For juveniles and adults, low DO can result in reduced fecundity and even prevent spawning. (Salmonids are also affected by many other factors: water depth, pH, velocity, turbidity and gravel characteristics for spawning. Assessments of streams for suitability consider all these parameters.)

Friends has been measuring temperature and DO in the watershed since 2008. While we have logged the temperature at 15-minute intervals, we measured DO only a few times a year when we installed and downloaded the temperature loggers. DO measuring equipment is expensive and challenging to maintain, which is why we used it infrequently. However, the amount of DO in creek water is as important as temperature as a measure of habitat quality.

On March 7 of this year Friends installed three loggers in Ross Creek that record both temperature and DO. We set them to record every 15 minutes. These instruments are fitted with a pre-calibrated optical sensor that will last 6 months. Collecting these data will greatly improve our DO records. We also installed three loggers that record only temperature, continuing our long-term temperature monitoring. Sadly, over the years we have had three temperature loggers stolen and several removed from the water.

Measurements of DO, taken during the March day when we were installing temperature loggers, showed very low levels of DO in the water that emerges from the release valve at the base of Phoenix Lake, with generally higher levels downstream, the result of natural aeration. However, as the summer progresses, water levels fall and temperatures rise, leading to generally lower DO levels throughout the creek. The continuously monitored DO at three separate locations will provide more detailed information and perhaps suggest ways to improve conditions for fish in Ross Creek.

We extend our thanks to the Marin County Fish and Wildlife Commission for funding the purchase of our new DO loggers and, over the years, half of our temperature loggers.


If You See an Illegal Discharge to Storm Drains or Creeks:

- During normal business hours call the contact listed below.
- After normal business hours call the Marin County Sheriff non-emergency line (415) 473-7233.
- For an emergency or a spill involving hazardous materials or hazardous waste call 911 or your local Fire Department
- For spills into creeks, wetlands, bays or the ocean: call the California Office of Emergency Services (Cal OES) at (800) 852-7550

If the discharge has already occurred and is not an emergency or immediate threat, contact:

<table>
<thead>
<tr>
<th>Location</th>
<th>Contact</th>
<th>Phone Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corte Madera</td>
<td>Chris Good</td>
<td>(415) 927-5057</td>
</tr>
<tr>
<td>Fairfax</td>
<td>Mark Lockaby</td>
<td>(415) 458-2370</td>
</tr>
<tr>
<td>Larkspur</td>
<td>Scott Metcho or Bob Quinn</td>
<td>(415) 927-5017</td>
</tr>
<tr>
<td>Ross</td>
<td>Anthony Alcozer</td>
<td>(415) 453-8287 (ext.163)</td>
</tr>
<tr>
<td>San Anselmo</td>
<td>Sean Condry</td>
<td>(415) 258-4616</td>
</tr>
<tr>
<td>Unincorporated Marin County</td>
<td>Will Stockard</td>
<td>(415) 473-6583</td>
</tr>
</tbody>
</table>
Time to Reflect  
Continued from Page 2

started playing acoustic music with friends and neighbors under a bridge over San Anselmo Creek. “The acoustics are good, as is the airflow.” Myself, I sometimes just enjoy listening to the sounds of the creek, rippling or roaring, and breathing the cooler, creek air. It is a relaxing respite from the ills plaguing our world today. And I would be amiss if I didn’t mention Sandy and Charlie who still carry on with a mission of ours: providing stewardship of the watershed’s natural resources by tending habitat restoration sites, or pulling invasive weeds in its open spaces. Thank you.

Lastly, a common thread in our reflections was our appreciation of family and friends, and the ability to share the paths and open spaces of the watershed with them. Many noted how nice people were, how they were always happy to share space so everyone had enough. “Many people stop to ask what I’m doing and to thank me,” says Sandy at a heavily traveled area where we steward a habitat restoration site. “It’s encouraging to see how many people care about our marsh.”

As a Friend, I would like to say, “Thank you, too,” for kindness is always appreciated in tough times like these. Take care, share some open space with others, and stay safe.

Calendar of Events  
July—December 2020

Please check www.friendsofcortemaderacreek.org for updates
Board meetings may be via Zoom if we are not meeting in person.

July  16   Monthly Board Meeting, Thursday, 7:00 p.m., San Anselmo Historical Society Room, 110 Tunstead Avenue, San Anselmo.

August  20  Monthly Board Meeting, Thursday, 7:00 p.m., San Anselmo Historical Society Room, 110 Tunstead Avenue, San Anselmo.

September  17  Monthly Board Meeting, Thursday, 7:00 p.m., San Anselmo Historical Society Room, 110 Tunstead Avenue, San Anselmo.

October  15  Monthly Board Meeting, Thursday, 7:00 p.m., San Anselmo Historical Society Room, 110 Tunstead Avenue, San Anselmo.

November  19  Monthly Board Meeting, Thursday, 7:00 p.m., San Anselmo Historical Society Room, 110 Tunstead Avenue, San Anselmo.

December  No meetings in December.

Thank You!

Friends of Corte Madera Creek Watershed wishes to thank the following individuals, organizations, and agencies for their contributions:

- San Anselmo Historical Society and the Town of San Anselmo for providing space for our monthly board meetings (when we can meet face-to-face)
- California Alpine Club Foundation for funding habitat enhancement
- The Coastal Conservancy for funding habitat enhancement
- The Marin Community Foundation and the Coastal Conservancy for funding designs to remove part of the concrete channel in Kentfield and College of Marin, and Marin County Water Conservation and Flood Control District, College of Marin, and Ross Valley Sanitary District for collaborating on the effort
- The Coastal Conservancy for funding designs to improve fish passage in the concrete channel in Kentfield and Ross and Marin County Water Conservation and Flood Control District for collaborating on the effort
- Marin County Parks for support of our work at Hal Brown Park by providing water for irrigation
- The Watershed Nursery for donating plants installed at Hal Brown Park
- Marin County Fish & Wildlife Commission for supporting water quality monitoring
- The many creek-side property owners who have given Friends permission to treat invasive cordgrass on their property
- Other dedicated volunteers who make our activities possible, including removal of invasives, and help with summer irrigation
- The many people who make financial contributions that allow us to continue our day-to-day work

Email Only
Would you prefer to receive information from us, including the next issue of Creek Chronicles, only in electronic form? Email to our address at info@friendsofcortemaderacreek.org. Put EMAIL ONLY in the subject line, include your name and mailing address from the label on the newsletter so we will know which hard copy to stop sending. We will send material to you in PDF files.
Friends of Corte Madera Creek Watershed was formed in 1994 and became a non-profit organization in 1996. Our goals are to protect the health of creeks in our watershed and help the public learn to care for creeks.

In mid-April, just after noon, two bat rays (*Mylobatis californica*) were spotted in the McAllister Avenue slough, a remnant of Corte Madera Creek’s original alignment, just downstream of the concrete channel in Kentfield. Every spring these rays gather in the shallow warm waters of coastal California’s bays and sloughs to feed, mate, and give birth. The creature’s wingspan can exceed five feet. Photo by Nick Salcedo.