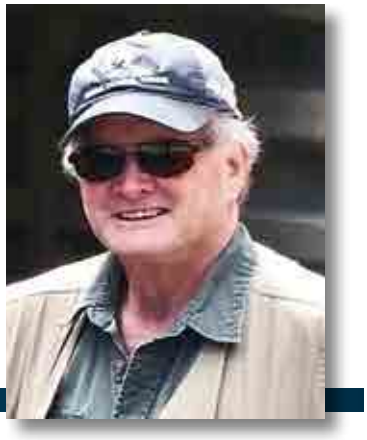
The Global Extinction Crisis, Alberta's Native Cutthroat Trout, and Wilderness



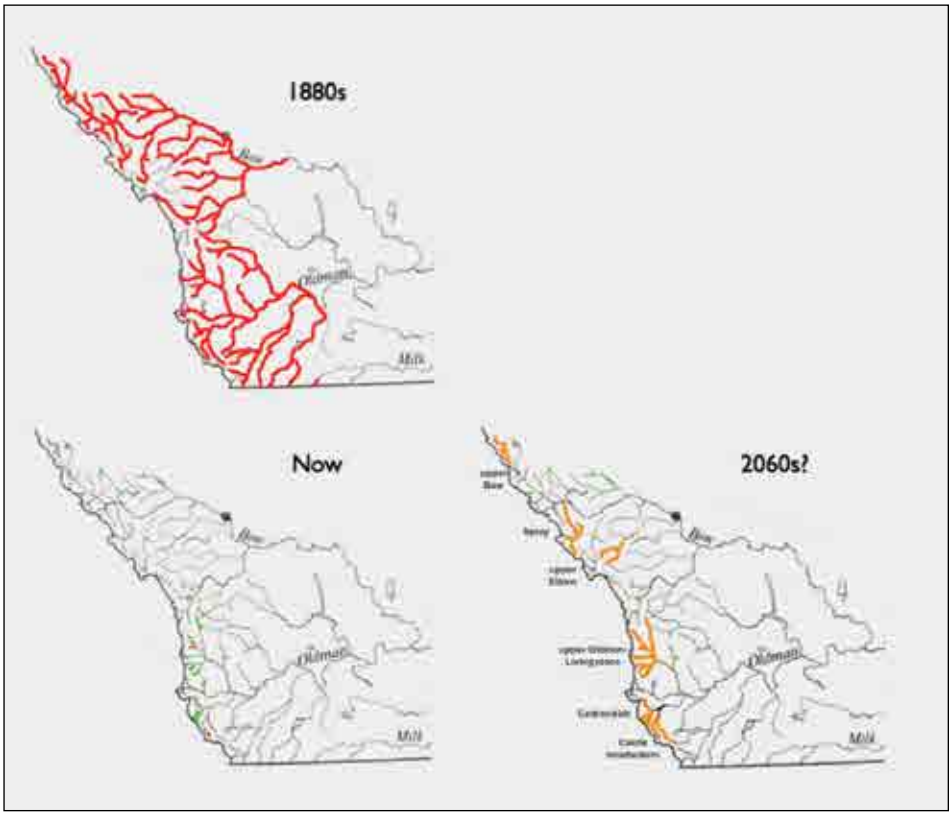
By Dave Mayhood

Earth is experiencing an extinction crisis unprecedented in human history

The International Union for the Conservation of Nature (IUCN) reports that, as of July 2018, 26,000 species of organisms are at serious risk of extinction worldwide. The rate of vertebrate species loss alone recently was estimated, very conservatively, at 114 times higher than the background rate. That rate is accelerating, supporting a developing view that Earth has entered its sixth mass extinction.

Yet even this extremely high rate of species loss may seriously underestimate the problem. In a huge sample of half the known vertebrate species, ecologist Gerardo Ceballos and colleagues recently reported in the *Proceedings of the National Academy of Sciences* that 32 percent of those species are decreasing in abundance and range. In 177 mammal species for which there are detailed data, all have lost 30 percent or more of their geographic ranges, and more than 40 percent of those species have shown severe population declines of greater than 80 percent shrinkage in their ranges. The World Wildlife Fund reported just weeks ago that there has been an overall decline of 60 percent in population abundance of all species between 1970 and 2014. Ceballos and his colleagues concluded that such massive losses "will have negative cascading consequences on ecosystem functioning and services vital to sustaining civilization."

And therein lies the great danger to humankind. Ecosystems consist of organisms and the places they live, interacting among themselves and with their physical habitats. Taken together, they are our life support system. Properly functioning ecosystems are not just nice to have, they are essential to our lives, making this planet habitable for humans. Such huge losses of ecosystem components — species and populations — as we are seeing now, signal that our life support machinery is coming apart. We urgently need to repair it.



An example of large losses in population abundance due to massive range reduction: Alberta native cutthroat trout since the 1880s. Red — genetically pure native; green — apparently pure native, with some hybrid individuals, or minimally hybridized; orange — speculatively reconstructed pure stocks as part of a recovery program. D. MAYHOOD GRAPHIC

Recovering native cutthroats: A primer of ecosystem repair

To show how complicated recovery can be, let's look at a single at-risk Alberta species to get a sense of how we need to go about recovering whole ecosystems.

Westslope cutthroat trout in Alberta once occupied the headwaters of the Bow and Oldman river drainages, extending downstream in the mainstem rivers far out into the plains. Historical records attest to their remarkable abundance. When the Canadian Pacific Railway was completed through southern Alberta in the 1880s, rapid set-

tlement became possible. Settlers heavily exploited the native fish stocks, depleted them, damaging or destroying trout habitat. On top of the depleted native trout stocks, the streams and lakes soon received heavy plantings of non-native fishes like brook, brown, Yellowstone cutthroat, and rainbow trout, all of which competed for food and space with the native cutthroat stocks. Worse, non-native rainbow trout hybridized with the cutthroats, extirpating them as a distinct species in stream after stream, and making them less fit than either pure parental stock. The competing species and hybrids have different ecological properties than the native stocks. As a result, ecosystem function has been changed in ways that we do not yet comprehend. Pure stocks of native cutthroats that still remain are small, highly fragmented populations dispersed in cold, isolated, and small headwater streams.

Extinction is a numbers game. When a population or species is reduced to zero, it is extinct. When effective populations are small, say less than 500 to 1,000 mature adults, they are at higher risk of extinction due to lost genetic diversity by chance, and to catastrophic events like floods, landslides, fires and the like. When effective stocks are as low as 50 to 100 adults, these mechanisms are accentuated, and weakening through inbreeding becomes an additional important factor. In either case, populations are more prone to extinction the smaller they are; most pure native cutthroat populations remaining in Alberta are very small, in the low tens to low hundreds of adults. The major problem to be solved, therefore, is to increase the effective adult population size of each of the remnant pure stocks to somewhere in the range of at least 500 to 1,000 adults.

Restoring native cutthroat stocks is complicated further, however, by the fact that they must be protected from invasion by rainbow trout genes. This usually means the rainbows or rainbow-cutthroat hybrids must be selectively removed from the trout-accessible habitat, or the pure stocks must be isolated above natural or artificial barriers. Selective removal involves serious technical difficulties so, at our present level of expertise, in most cases we are restricted to the habitat isolation approach.

The isolated habitats selected for conserving the pure stocks must be sufficiently productive, and have enough critical habitat (such as pools or emergent groundwater), to support a population of a large enough size. The habitats must have suf-

Rewilded wilderness like this formerly roaded headwater of the Elbow River, with natural barriers to upstream invasion by non-native fish species, offer opportunities to remove invasive fishes and maximize stream carrying capacity for pure Alberta native stocks of trout as part of a recovery plan. PHOTO: © D. MAYHOOD

ficient carrying capacity, in other words. Increasing productivity naturally is limited by our climate and geology; artificially increasing habitat productivity tends to be temporary and expensive. In most cases, our populations need more habitat in the form of mileage: our fish need greater lengths of stream available to them as secure habitat. Most opportunities to provide greater stream length and better habitat security generally are downstream from the remnant populations and are typically occupied by rainbows or rainbow-cutthroat hybrids. Downstream also tends to be the direction in which conflicts with resource extraction, urbanization, and grazing lie. Habitat damage, meanwhile, can be expected to foster hybridization and competition from invasive rainbow and brook trout. Secure, undamaged habitat is key to recovering this species.

But, we're not done. The remaining populations of pure native cutthroats are likely each locally adapted to their native streams and these adaptations are genetically determined., We also need to take steps to preserve genetic diversity, so we may need to add a few fish from other pure native populations to increase genetic diversity and thereby improve the fitness of small populations. But we need to be extremely circumspect in doing so. Introducing other genotypes could disrupt locally-adapted gene complexes.

These and many other complications make recovering severely depleted fish stocks extremely daunting. Such problems are the rule if we have to restore populations of any species — such as Alberta's at-risk plants, caribou, bull trout, Athabasca rainbow trout, and sage grouse — to anything like their natural state. To get a sense of why it is far better to prevent species and populations from declining to dangerously low numbers rather than to wait until they're at risk, just multiply the problems outlined above for cutthroat trout by the number of species and populations at risk that you need to recover. Globally, as noted, that number is more than 26,000 and climbing rapidly.

Wilderness: Functional ecosystems

It should now be obvious that we need a much more effective way to recover and protect at-risk species and populations. Even more importantly, we need to do more to prevent them from ever becoming at risk in the first place. Restoring and protecting wilderness offers one such way.

Wilderness is another word for functional, intact ecosystems, but you probably will not find it described that way in dictionaries or in wilderness legislation. The U. S. *Wilderness Act* defines wilderness, in part, as "an area where the earth and its community of life are untrammeled by man…An area of wilderness is further defined to mean in this Act an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation…" An area of wilderness, according to the Act, is one of "at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition." Elsewhere in the Act, The Secretary of the Interior is enjoined "to review every roadless area of five thousand acres or more" in lands within his jurisdiction to determine its suitability as designated wilderness. The Act also prohibits roads within wilderness areas. Since roads are an excellent proxy for human development and "permanent improvements" it made a lot of sense for the American Congress to envision wilderness as the absence of roads.

It follows that wilderness can be maintained by the simple expedient of not allowing roads to be built into roadless areas. Lands can be returned to wilderness status by removing roads.

Lands that have always been without roads are self-maintaining ecosystems within which the species native to the wilderness area can adapt and evolve at population levels commensurate with the carrying capacity of that ecosystem. This is the very goal of conservation.

While wilderness alone cannot guarantee the safety and recovery of native species, it can go a long way toward making it possible. In an article this year in the journal *Oryx,* conservation biologists Stephen Kearney and colleagues found that protected areas alone in Australia could remove one or more threats to 76 percent of species, but all threats only to three percent of species. With adequate resourcing (active management), a protected area network could remove one or more threats to almost all species and all threats to almost half of the species protected within it.

Two years ago, James Watson and colleagues showed alarming declines (10 percent loss over two decades) in wilderness globally: double the rate of wilderness protection. Yet wilderness preservation is likely the single most effective way of conserving large numbers of species and their individual populations. Similarly, restoring to wilderness large, partly developed landscapes that still harbour species at risk is likely to be one of the most effective means of efficiently recovering those species and restoring their critical habitats. Recent moves by the Alberta Government to do just this in the Castle Parks, the Livingstone-Porcupine area, and now in Bighorn Country, are giant steps in this direction.

U.S. President Franklin D. Roosevelt is often paraphrased as advising petitioners, "I agree with you, I want to do it, now make me do it." By persisting over decades, AWA has followed FDR's dictum. Its longterm, persistent efforts have been important in making it possible for the government to achieve these advances. We can expect them to help conserve many of our species at risk, and to do our part in stemming the catastrophic loss of global biodiversity.

Dave Mayhood is an aquatic ecologist working on recovering Alberta's threatened native west-slope cutthroat trout and the watersheds they live in. He can be reached via his corporate website at fwresearch.ca

CORRECTION

Our biography of George Campbell in the September issue of the Wild Lands Advocate stated that "George was the founder and first President of the Foothills Acoustic Music Institute (FAMI)." This is incorrect. Marilyn Giesbrecht was the first President and one of the founders of FAMI. We apologize to both Marilyn and George for this error.