COVID, Climate Change, and Professional Travel: Reflections by Fisheries Scientists During the Pandemic

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The global lockdowns brought on by the COVID-19 pandemic forced an immediate change in the way people moved about; namely, travel was slowed from a turbulent river to a trickle. In-person meetings, often involving long-distance flights, were either canceled, postponed, or shifted over to virtual modes. People who were unfamiliar with online meetings quickly became acquainted with them. Zoom, a previously small web-based meeting platform, abruptly expanded to global extent, with many universities rapidly adopting it and similar apps for meetings and classes suddenly forced to go virtual.

The change to "a new normal" coincides with increased warnings by environmental scientists about the dire consequences of continued greenhouse gas emissions into the atmosphere (e.g., Laffoley and Baxter 2019; Ripple et al. 2020). As fisheries scientists and managers, we are aware of many changes resulting from altered climate based on what we already observe: the poleward movements of marine species, losses of thermally intolerant species as inland waters warm, rising sea levels, increased storm strength, increased frequency of lower pH and deoxygenation events (Winfield et al. 2016; Breitburg et al. 2018; AFS 2020). We focus our research efforts on climate change, attempting to anticipate how it might affect the particular ecosystems we study and how we might mitigate those changes.

And yet, like most people, we've had a hard time adjusting our lifestyles to do our part in the fight to lower greenhouse gases. But there is a conversation that must be held among academics and other professionals, particularly those in the environmental sciences who should know better. Indeed, we two authors personify the behavioral gradient of professional travel. Before COVID, KL was planning travel in 2020 to Sweden, China, Corsica, and Australia from the United States. Even with good connections, this would have loaded 14 metric tons of CO_2 into the atmosphere—and all for work-related activities, all involved one way or another with climate change! Residing in France, FD decided in 2014 to stop traveling by air as much as possible.

Here, we present our reasoning for our decisions, and to discuss alternatives that all environmental scientists should seriously consider. This is meant to help increase awareness of the problem, and to consider climate change and travel going forward. We do this in the form of a transcontinental conversation.

KL: I'm fully aware of the hypocrisy of air travel for work and have tried to use alternative transportation when possible. For example, I took the Amtrak train from Syracuse, New York to Minneapolis/St. Paul, Minnesota for the American Fisheries Society (AFS) Annual Meeting in 2012. It took much longer, but I planned for it and so could work and read on the train. During fall 2019 and early winter 2020 (pre-pandemic), I participated in grant review panels in Washington, D.C. and traveled down by train, but had to fly back. The reason for flying home was because there are no good train schedules from D.C. to Syracuse—I don't relish the idea of disembarking at 2:30 in the morning. And, as many Americans know, our rail system is sadly lacking when compared to other parts of the world. There is simply not enough capacity or maintenance of the U.S. passenger train system to accommodate much more traffic. This was brought home in 2008 during a spike in gasoline prices; automobile travelers turned out to be very sensitive to the price hike, and the trains were packed to capacity. To be able to transition to a low-CO_2 travel lifestyle, the USA will need to invest heavily in rail and train infrastructure, not to mention serious investments in fuel efficient cars and trucks, and roads designed to reduce fuel consumption.

FD: As scientists working on fish, often endangered species, we have a responsibility to act towards a reduction of our carbon load. Our problem is that we are encouraged to travel a lot, because international collaborations are most valued. However, if we do not model better behaviors, with lower carbon load, we are creating a contradiction between the alarming results of our research and our personal actions.

Is air travel critical to our careers? Arsenault et al. (2019), studying travel patterns at the Université de Montréal, found that 67% of academic air travel was for attending conferences and workshops, which are key components of academic work, but above a minimum threshold, increasing air travel did not improve scientific careers or scientific outcomes.

We have great responsibility as researchers, and we are exposed to the critics who claim hypocrisy. Therefore, we cannot separate the researcher and the citizen. Worldwide, we researchers are generally middle or upper middle class, economically. We have the knowledge, which means that we can plan our travel more wisely. I catch the train to attend my meetings in France and in Europe, whenever possible.

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As KL noted, this choice is very difficult to achieve in practice, because discount airlines have lowered considerably the cost of traveling across Europe. My French administration denied me the right to travel by train to the United Kingdom, because the train ticket was higher than low-cost air fare. However, if all hidden costs apart from the trip are considered, the real price is much higher. For example, airports for low cost companies are far away from cities and require a costly taxi fare, plus it is almost impossible to work during the trip (terminals and planes are uncomfortable; there are long waiting times before departures, in security lines and customs, and when waiting for luggage; schedules are unreliable, sometimes they mean spending the night at the airport).

The COVID-19 crisis could reshape the transportation infrastructure, because airline companies have suffered considerably from the crisis. People are more reluctant to travel far away for tourism under the risk of COVID contamination.

As in the USA, European train infrastructure has been severely depleted, to the point that only trips to the capital cities are really reliable. However, it is worth the effort. Although train journeys require more time than plane trips, the time spent in trains can be very productive. I spent 5 hours for a Bordeaux-to-Brest trip, comfortably working like in my office with fast internet service. I also found a night train to travel to Lisbon. The other advantage of the train for me is the possibility to travel with my bike for local trips, which allows me to connect to my final destination carbon free. As citizens and scientists, we should encourage the rebirth of train infrastructure that could allow us to travel smoothly to our national meetings. For me, Japan is one of the best train destinations in the world, because it combines long-distance and local train infrastructures that are very efficient. I have also used a ferry to attend a meeting in Mallorca (Balearic Islands, Spain), which I found easy and flexible, because I chose night ferries, which saved me a lot of travel time. I am considering taking ferries to travel to Scandinavia or Ireland in the future.

Another practice I have integrated in my trips for work is sharing cars whenever I really need one. The simplest example is the organization of trips to the train station or airport (when I could not avoid plane travel) with colleagues before and after conferences and meetings. For local or national meetings, I look at the attendees list and addresses and ask local people for a shared trip.

KL: But for intercontinental travel, there are few options. I wish that we all had access to fine sailboats like Greta Thunberg hitchhiked on to the UN Climate Conference in 2019, but it will be a long time before widespread use of sea travel is again possible, if at all. And as pointed out by Kjellman (2019), a PhD student conducting her climate science research in the Arctic, she must make at least some trips for her own research and professional development.

As has been pointed out a number of times (e.g., Nevins 2014; Wynes et al. 2019), travel for conferences has become a major component of many academics' annual carbon footprint. As a case in point, I made a rough calculation of the CO_2 emissions generated by a small, highly international conference on otolith research that FD and I both attended in 2018, in Taiwan. The 188 attendees who traveled by plane logged over 3.43 million km altogether, equivalent to 86 Earth circumferences and about 17,000 metric tons of CO_2 (assuming 5 kg CO_2 per person-km in air travel). For the average attendee, the round trip equates to several years of automobile commuting in terms of generating greenhouse gases. But the value of this conference, which occurs only once every 4–5 years, is undeniably huge in the development of our academic field and its applications worldwide. Thus, we have to balance the trade-off of travel and the benefits gained from attending. This is the dilemma we face.

FD: I think we must slow down, and prioritize carefully our attendance at conferences and meetings far away from our laboratory. During my career, I had to restrict my attendance to distant international meetings to every 2 years, because of lack of funding and also for a personal reason (my son), and now that these constraints have been reduced for me, I voluntarily restrict my attendance this level of travel or less, by setting priorities.

Equity and inclusion are equally important issues when addressing travel reduction for scientists. While the use of virtual meetings encourages attendance of scientists who have fewer opportunities for traveling (because of lack of resources, family care, health issues, or living in a remote location), other barriers may exist, such as language or internet connection quality. There is also a gender issue lurking here. As seen during the lockdown, at least in France, the inequality between genders in terms of time spent caring for children and household work increased dramatically by a factor of four (https://bit.ly/39S1IhB). In a context of increased virtual meetings, and fewer meetings with longer attendance, the question "who's going to look after the kids?" should be far less of an issue. However, the fact that women end up on average with more of the "home work" during the pandemic suggests that creating a code of fair play, as regards sharing the work load and allocating time to professional work, is a conversation that needs to happen, regardless of ethnic origin or class.

I hope that trans-Atlantic trips will be again possible by ship. A cargo ship takes 5–7 days to cross the Atlantic, which is longer than a plane trip, but it could be an opportunity to reach the conference venue with a fully ready presentation and perhaps another manuscript written.

Concerning travel we must do for our research, here we also need to lower the carbon impact. This means that we have to conceptualize it and reorganize our research with this aim. I think the Tara expeditions (environmental data collection using the schooner *Tara*; available: https://bit.ly/3s2hzAu) is a great example of a brilliant idea to use sailing to sample across the oceans. Tara expeditions provided more than 300 publications from more than 80,000 samples, demonstrating that low carbon impact expeditions can provide high quality, innovative science. At a more modest scale, I had the opportunity to organize a 350-km human powered kayak expedition (zero waste and self-contained) along the Garonne River that gave me original and innovative observations on the environment and ecology of shads *Alosa* spp. Of course, it took me 15 days, including weekends, but it was the same amount of time as the expedition to the Mariana Ridge I had made with a Japanese team a few years ago. I am keen on creating other low carbon methods of observation.

I think we also have to make "think global, act local" a motto for research. Which means that we should promote and encourage sampling by locals in countries where research is poorly developed. I think the promotion of citizen science could pave the way to sampling with protocols defined in collaboration between scientist and citizens and then, sampling could be achieved by locals and sent over for analysis. This would help to build local capacity and interest in the environment.

KL: Of course, a lot boils down to individual decisions and choices. Take going to professional meetings, for example. For many professional society members, attending a national or international meeting is the high point of their year. The networking opportunities are incredible, and the entire experience is highly rewarding. In addition, if the meeting is held in an attractive locale, many attendees bring their families and combine the meeting with a vacation (thereby increasing the CO_2 footprint if they're flying). But based on our experiences this year with COVID-19, we can in fact attend many meetings online, and many are at least as good if not better, in some ways. This forces us to re-think face-to-face meetings.

For many, if not most professional scientific societies, annual meetings are a critical revenue stream. Reducing meeting attendance would have severe consequences for running the secretariat. If we are serious about tackling the causes of climate change, we probably have to think very creatively about maintaining the health of the professional societies while dealing with travel. For example, could we have hybrid national conferences with satellite meetings, as practiced by some groups, such as the Bioneers? These would facilitate regional gatherings, but with many events shared by every group. This wouldn't prevent people from traveling further, but it would provide a lower travel–cost alternative that many would likely take advantage of.

FD: Clearly, I much prefer low-tech solutions to travel. Of course, online meetings can be an alternative, but we should also consider the carbon impact of the cloud-based gatherings.

For me, a practical motto is, similar to zero waste: *Refuse*, *Reduce*, *Reuse*, *Recycle*.

Refuse: as individuals, we could give priority to attend the most important meetings and refuse attendance to less important meetings.

Reduce: I advocate for individual restriction of air travel to a maximum of one remote conference per year per person. This quota could be mutualized in a laboratory team, so that decision on air travel amount could be taken collectively.

Reuse: choose alternative ways of exchanging ideas, such as video conferencing, attending smaller regional or local meetings, and meeting less often, for longer times. We could imagine meetings for 2 weeks, or 3 weeks, every 2 years. Calculate the location of meetings to minimize travel at a global level (this means simpler venues).

Recycle: choose travel modes other than plane, i.e., by bike, by train, by boat, by sharing cars, etc.

KL and FD: As pointed out in Limburg et al. (2011), human populations and our economies are growing, putting us on a collision course with the biosphere. The violent climate events of 2020 are a stark warning of what is to come if we continue on this path. Most professional societies also follow the growth model—we have not figured out a way out of this pattern. And yet we, as environmental scientists, need to work with our communities of academics and practitioners to lower our impact. Some of the change needed is systemic and will require macroeconomic policy revamping.

But let's think about how to achieve some reductions voluntarily in ways that still can accommodate our careers. Institutions where people work could help to incentivize better travel patterns, and societies such as AFS might help conference attendees to link up with fellow travelers. Equity and inclusion issues are important too, but are beyond the scope of this reflection. However, we note that last year's AFS Virtual Annual Meeting enabled many people from lower and middle income countries to attend and present, and this mode of attendance will be carried forward, even when face to face meetings are restored, such as this coming fall for AFS. We would love to open a conversation with other professionals to create not only mechanisms, but actual incentives for lowering our CO_2 footprints. This is the time to get creative!

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