**Supplemental 2**

The following R script was used to determine the percentage of lake area above 3 meters depth.

### This is a script that pulls individual .tif bathymetry files from <https://www.nature.com/articles/s41597-022-01132-9>

### and calculates the area of the lake with depths "LESS THAN/SHALLOWER THAN" 3 meters. A proxy for ebullition emissions following Bastviken et al.,2004

# Clear your environment and memory

rm(list=ls())

gc()

library(dplyr, warn.conflicts = FALSE)

library(tidyr, warn.conflicts = FALSE)

library(stars, warn.conflicts = FALSE)

library(units, warn.conflicts = FALSE)

library(doParallel, warn.conflicts = FALSE)

library(utils, warn.conflicts = FALSE)

bathy <- c(list.files("/Volumes/SeagateBackupPlusDrive/Bathymetry\_Rasters/", pattern='.tif', recursive = T))

extract\_littoral <- function(bathy){

whole <- stars::read\_stars(paste0("/Volumes/SeagateBackupPlusDrive/Bathymetry\_Rasters/",bathy,"")) %>%

sf::st\_as\_sf(.) %>%

dplyr::rename\_at(1, ~'depth\_m') %>%

dplyr::mutate(lake\_area\_m2 = st\_area(geometry)) %>%

sf::st\_drop\_geometry(.) %>%

units::drop\_units(.) %>%

dplyr::summarise(lake\_area\_km2 = sum(lake\_area\_m2)/1000) %>%

dplyr::mutate(hylak\_id = sub(".\*/", "", bathy),

hylak\_id = stringr::str\_extract(hylak\_id, "[^\_]\*"))

lit <- stars::read\_stars(paste0("/Volumes/SeagateBackupPlusDrive/Bathymetry\_Rasters/",bathy,"")) %>%

sf::st\_as\_sf(.) %>%

dplyr::rename\_at(1, ~'depth\_m') %>%

dplyr::mutate(max\_depth\_m = max(depth\_m, na.rm = T)) %>%

dplyr::mutate(mean\_depth\_m = mean(depth\_m, na.rm = T)) %>%

dplyr::filter(depth\_m <= 3) %>%

dplyr::mutate(littoral\_area\_m2 = st\_area(geometry)) %>%

sf::st\_drop\_geometry(.) %>%

units::drop\_units(.) %>%

dplyr::summarise(mean\_littoral\_depth\_m = mean(depth\_m),

max\_depth\_m = mean(max\_depth\_m),

mean\_depth\_m = mean(mean\_depth\_m),

littoral\_area\_km2 = sum(littoral\_area\_m2)/1000) %>%

dplyr::mutate(hylak\_id = sub(".\*/", "", bathy),

hylak\_id = stringr::str\_extract(hylak\_id, "[^\_]\*")) %>%

dplyr::left\_join(., whole, by = "hylak\_id") %>%

dplyr::mutate(littoral\_fraction = (littoral\_area\_km2/lake\_area\_km2)) %>%

dplyr::select(hylak\_id, max\_depth\_m, mean\_depth\_m, littoral\_fraction) %>%

utils::write.table(., file = paste0("./output\_data/global\_littoral\_area.csv"),

append = T,

row.names = F,

col.names = !file.exists("./output\_data/global\_littoral\_area.csv"))

return(unique(bathy))

}

s = Sys.time()

no\_cores <- detectCores()-2

cl <- makeCluster(no\_cores, type="FORK")

registerDoParallel(cl)

foreach(i=bathy) %dopar% extract\_littoral(i)

e <- Sys.time()

t=e-s

print(t)