Cholera outbreaks at Lake Tanganyika induced by Climate Change?

CHOLTIC

Research project 2011-2015

Lakes as Source of Cholera Outbreaks, Democratic Republic of Congo

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We studied the epidemiology of cholera in Katanga and Eastern Kasai, in the Democratic Republic of Congo, by compiling a database including all cases recorded from 2000 through 2005. Results show that lakes were the sources of outbreaks and demonstrate the inadequacy of the strategy used to combat cholera.

The association between *Vibrio cholerae* and aquatic environments has long been studied, but emphasis has been almost exclusively placed on coastal areas such as the Bay of Bengal, the point of origin of cholera. There, outbreaks are closely linked to estuarine areas, where environmental *V. cholerae* strains emerge and then spread in human communities during the monsoon season (*1*) by attaching themselves to surfaces provided by plants, algae, and zooplankton (*2*,*3*). Some recent studies have investigated environmental and climatic factors that may encourage the spread of cholera in African countries (*4*,*5*); these studies also focused on coastal areas. Except for 2 case–control studies performed in Burundi and Kenya (*6*,*7*), little is known about the epidemiology of cholera in inland areas of Africa. A recent article, based on the analysis of 632 reports of cholera outbreaks worldwide, has shown that 87.7% of cholera cases occurred in sub-Saharan Africa and that the highest concentration of outbreaks was in the eastern provinces of the Democratic Republic of Congo (DRC) (*8*). In this country, dozens of emergency programs have been implemented by humanitarian organizations, national health services, and international agencies; they have, however, failed to achieve long-term control of cholera epidemics. To search for environmental factors that could explain the recurrence of cholera outbreaks, we conducted an epidemiologic study in 2 inland provinces of the DRC severely hit by cholera.

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The Study

From 2002 through 2005, reports of cholera cases and deaths from cholera were collected weekly from each health district of Katanga (497,076 km², 9,598,380 inhabitants) and Eastern Kasai (170,103 km², 6,713,009 inhabitants) with the help of local and national staff of the DRC Ministry of Health. The definition of a case-patient was "any person 5 years of age or older in whom severe dehydration develops or who dies from acute watery diarrhea"; the age limit was lowered to 2 years for cases associated with confirmed cholera outbreaks, as recommended by the World Health Organization (WHO) (*9*). Each new outbreak was confirmed by culture and identification of *V. cholera* O1 from 5 to 10 stool samples.

For 2000 and 2001, only cumulative data collected weekly in each province were available; no detailed database was kept. However, data were completed with information from reports of epidemic investigations and interventions (105 reports filed from 1999 through 2005) and the testimonies of medical teams interviewed during field visits. A geographic information system was established, based on the data collected from the 106 health districts of the 2 provinces. Six health districts were removed from statistical analysis because >10% of weekly reports were missing (Figure 1). Using regression techniques (see online Technical Appendix, available from www.cdc.gov/EID/content/14/5/798-Techapp.pdf), we statistically examined the relationship between the number of cholera cases in each health district and the following list of geographic and environmental variables: area; population; and presence/absence of cities of >100,000 inhabitants, of railway stations, of harbors, of major tracks or roads, and of lakes.

A total of 67,738 cases and 3,666 deaths (case-fatality rate 5.4%) were reported from 2000 through 2005 in Katanga and Eastern Kasai, which corresponded to 8.4% of

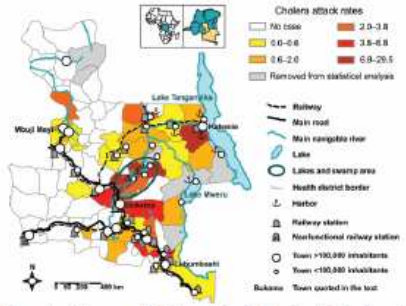
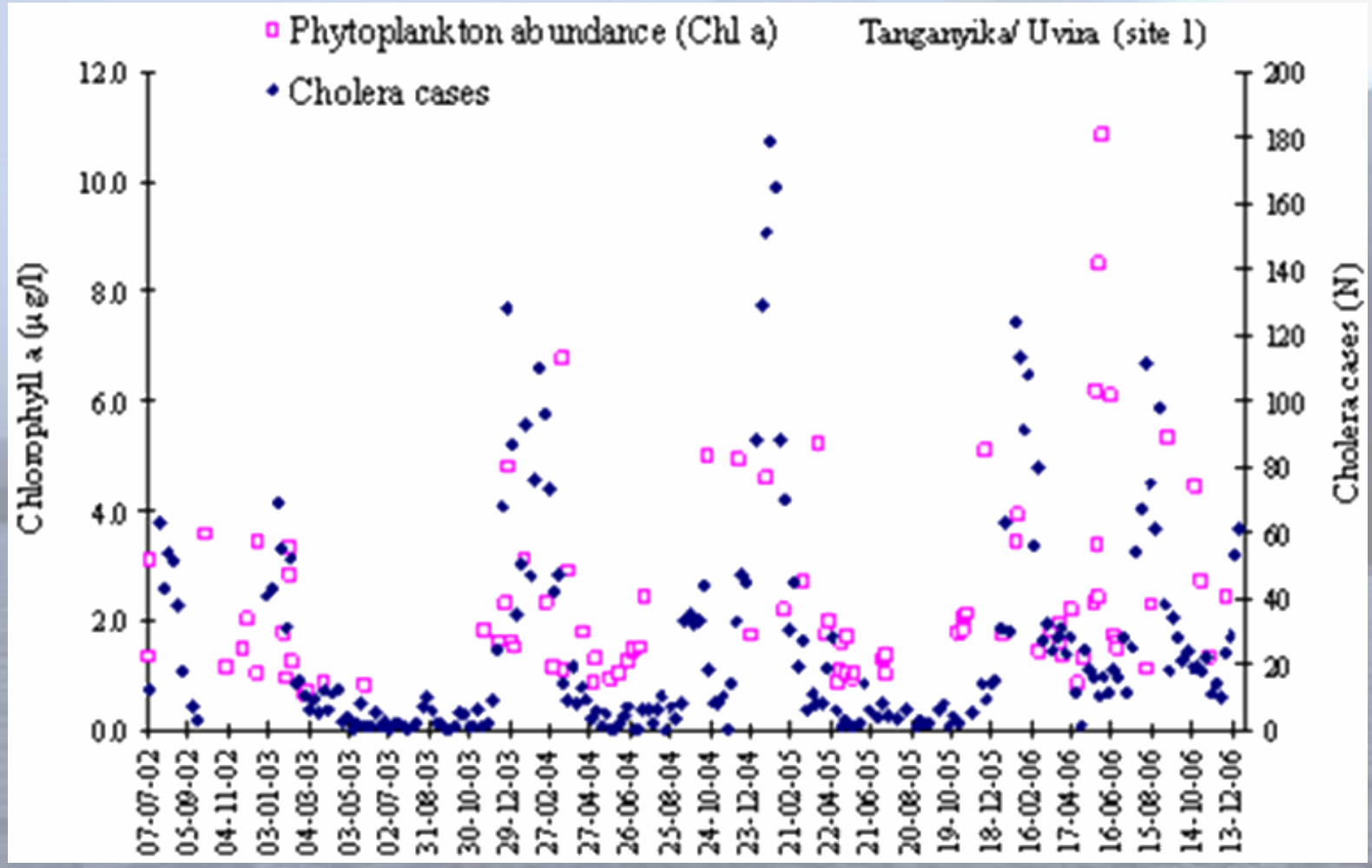


Figure 1. Katanga and Eastern Kasai, showing distribution of cholera attack rate from 2002 through 2005 and average attack rate of cholera per 10,000 inhabitants per health district.

Bompangue et al. 2008. Lakes as Source of Cholera Outbreaks,Democratic Republic of Congo. Emerging Infectious Diseases 14 (5):798-800

Apparent correlation plankton vs cholera in Tanganyika



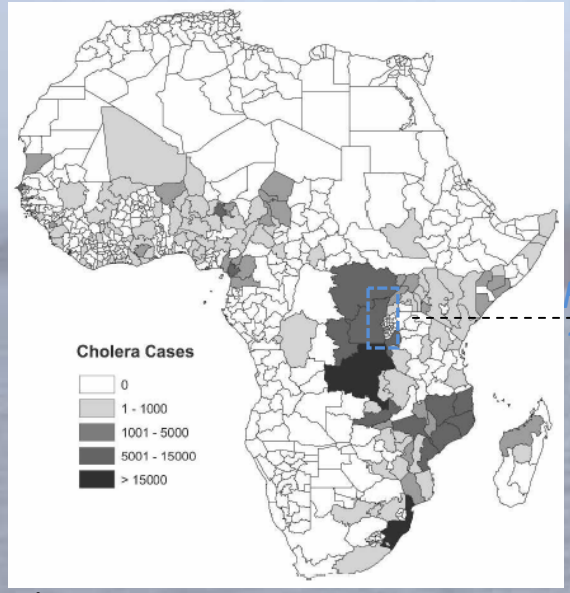
Cholera cases from DLM (D. Bompangue)
RS data from CLIMFISH (BELSPO/Stereo)

CHOLTIC

Objectives:

to investigate the role of great lakes as environmental reservoir of CHOLERA in Central Africa and early warning.

Africa : 82 % of world cases



(Griffith et al., 2006)

Focus: Lake Tanganyika

CLIMATE CHANGE

↓

LIMNOLOGY

↓

PLANKTON

↓

BACTERIA

↓

EPIDEMICS

Teams

RMCA (Belgium)
CRH (RD Congo)
DOF (Zambia)

NBGB,ULG, UCL (Belgium)

DLM & INRB (RD Congo)
IMT (Belgium)
APHM (France)

Preliminary results indicate links betwen cholera and plankton blooms

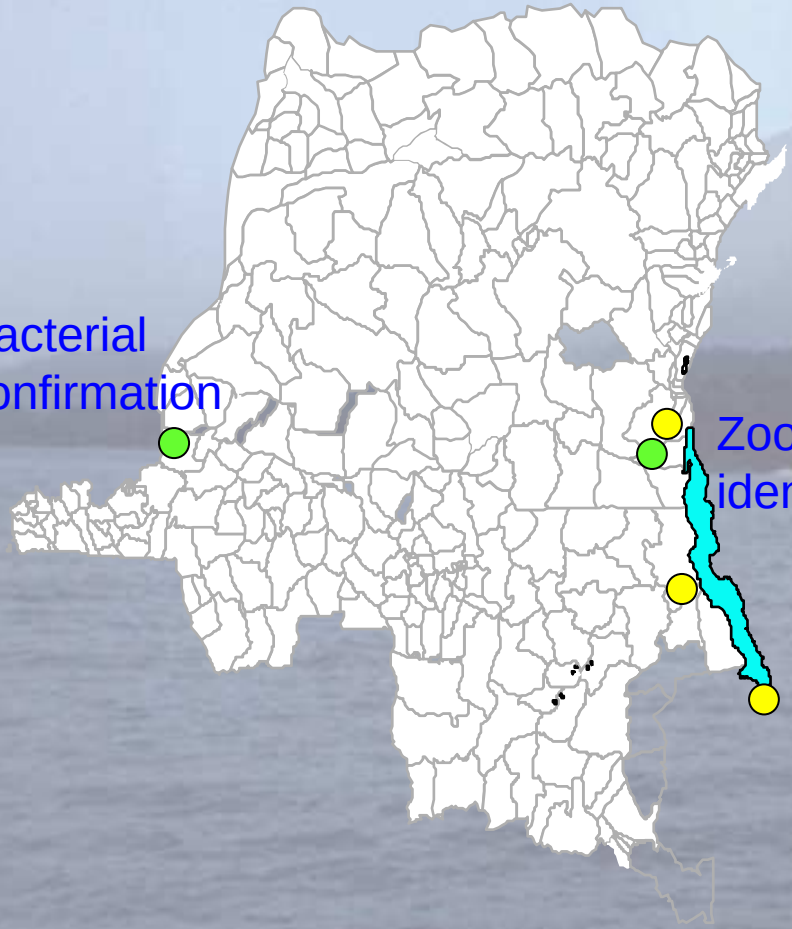
CHOLTIC Monitoring

Bacterial genetics

Phytoplankton identification

Statistical analysis

Modeling



Bacterial confirmation

Zooplankton identification

Remote sensing

Chl a
K490
SST

Climate

Limnology

Phytoplankton

Zooplankton

Bacterial contamination

Epidemiology

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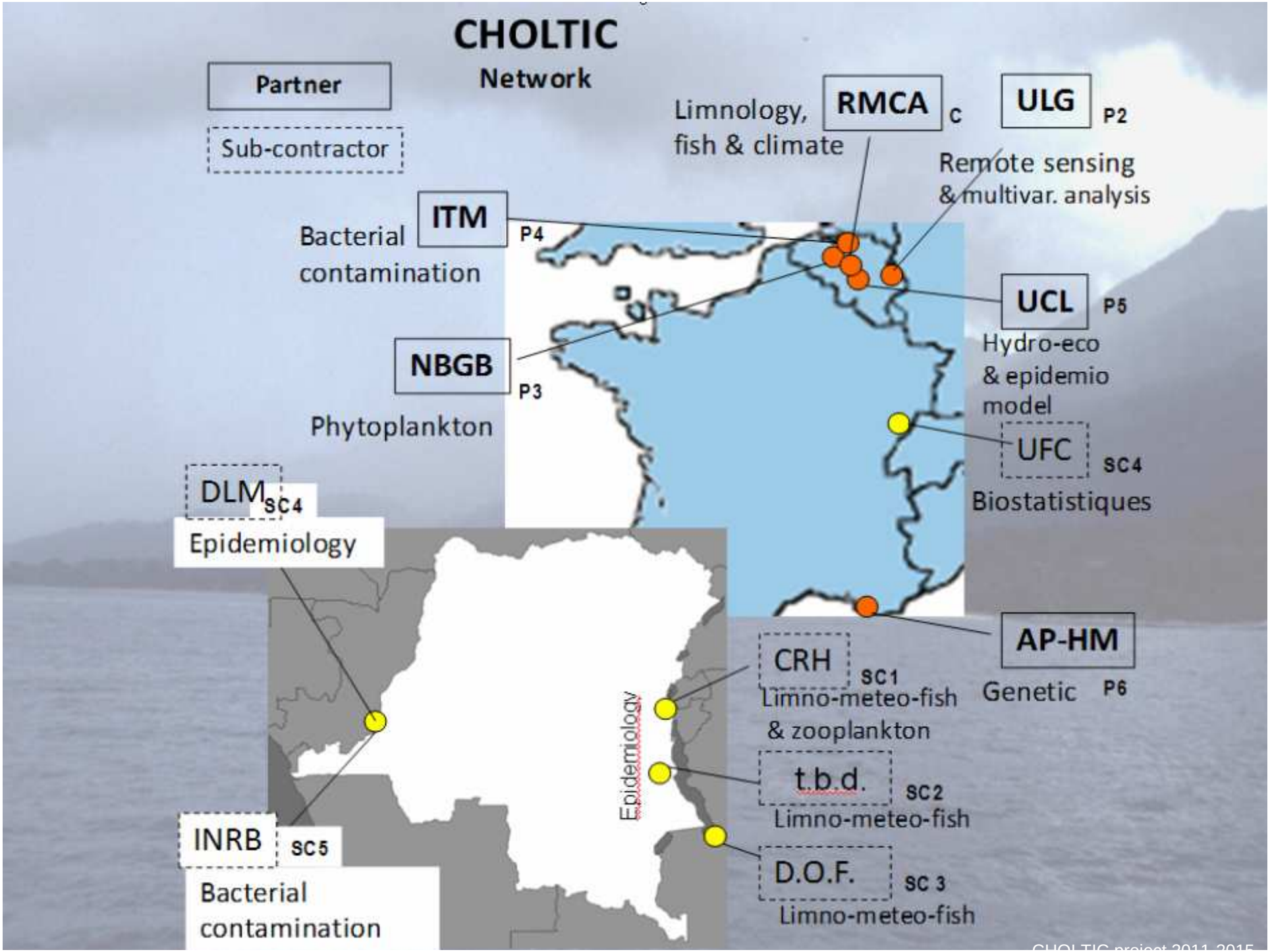
CHOLTIC
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Limnology, fish & climate
RMCA C
ULG P2
Remote sensing & multivar. analysis
ITM P4
Bacterial contamination
UCL P5
Hydro-eco & epidemio model
NBGB P3
Phytoplankton
UFC SC4
Biostatistiques
DLM SC4
Epidemiology
AP-HM
Genetic P6
CRH SC1
Limno-meteo-fish & zooplankton
Epidemiology
t.b.d. SC2
Limno-meteo-fish
INRB SC5
Bacterial contamination
D.O.F. SC 3
Limno-meteo-fish
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belspo


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FINANCING

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