WATER QUALITY AND PUBLIC HEALTH

PRESENTED BY:

DR. ANTHONY Y. KARIKARI & MARK OSA AKRONG

CSIR – WATER RESEARCH INSTITUTE

23RD FEBRUARY, 2017

PRESENTATION OUTLINE

- INTRODUCTION
- WATER QUALITY MONITORING
- WATER SOURCES IN GHANA AND COVERAGE
- PUBLIC HEALTH
- MAJOR RIVER BASIN IN GHANA
- STATE OF WATER QUALITY
- CHALLENGES
- RECOMMENDATIONS

WATER RESEARCH INSTITUTE

INTRODUCTION

- Sustainable Development Goals (SDGs) has a universal goal of ending poverty, protecting the planet and ensuring that all people enjoy peace and prosperity.

- SDG 6 addresses the issues of drinking water, sanitation, hygiene, and the quality and sustainability of water resources worldwide.

- About 6.6 billion people in 2015 (91%) of the global population, used an improved drinking water source, whereas 663 million used unimproved water sources.

INTRODUCTION CONT'D.

- About 1.8 billion people in 2012 were exposed to drinking water sources contaminated with faecal matter.

- Globally, about 4.9 billion people in 2015 used an improved sanitation facility. However, 946 million people lacked adequate sanitation facilities.

- In 2011, 41 countries were said to have experienced water stress, hindering the sustainability of natural resources, as well as economic and social development

Source: UN, 2016

WATER QUALITY MONITORING (WQM)

- Water quality describes the state of the water including its physical, chemical and biological characteristics with regards to its suitability for a particular purpose.

- Basic selected parameters used in assessing drinking water quality:

☐ Physical (pH, Temperature, TDS, TSS, Colour Turbidity, Conductivity, etc.)

☐ Chemical (NO_3-N, NH_4-N, PO_4-P, BOD, COD, DO, etc.)

☐ Bacteriological (Total coliform, Faecal coliform, *E.coli*, Total Heterotrophic bacteria, etc.)

☐ Institutions involved in WQM: WRI, GWCL, CWSA,WRC, PURC , etc.

MAIN WATER SOURCES IN GHANA

RAW WATER

➢ SURFACE WATER:
River, Streams, Lakes & Reservoirs, Ponds
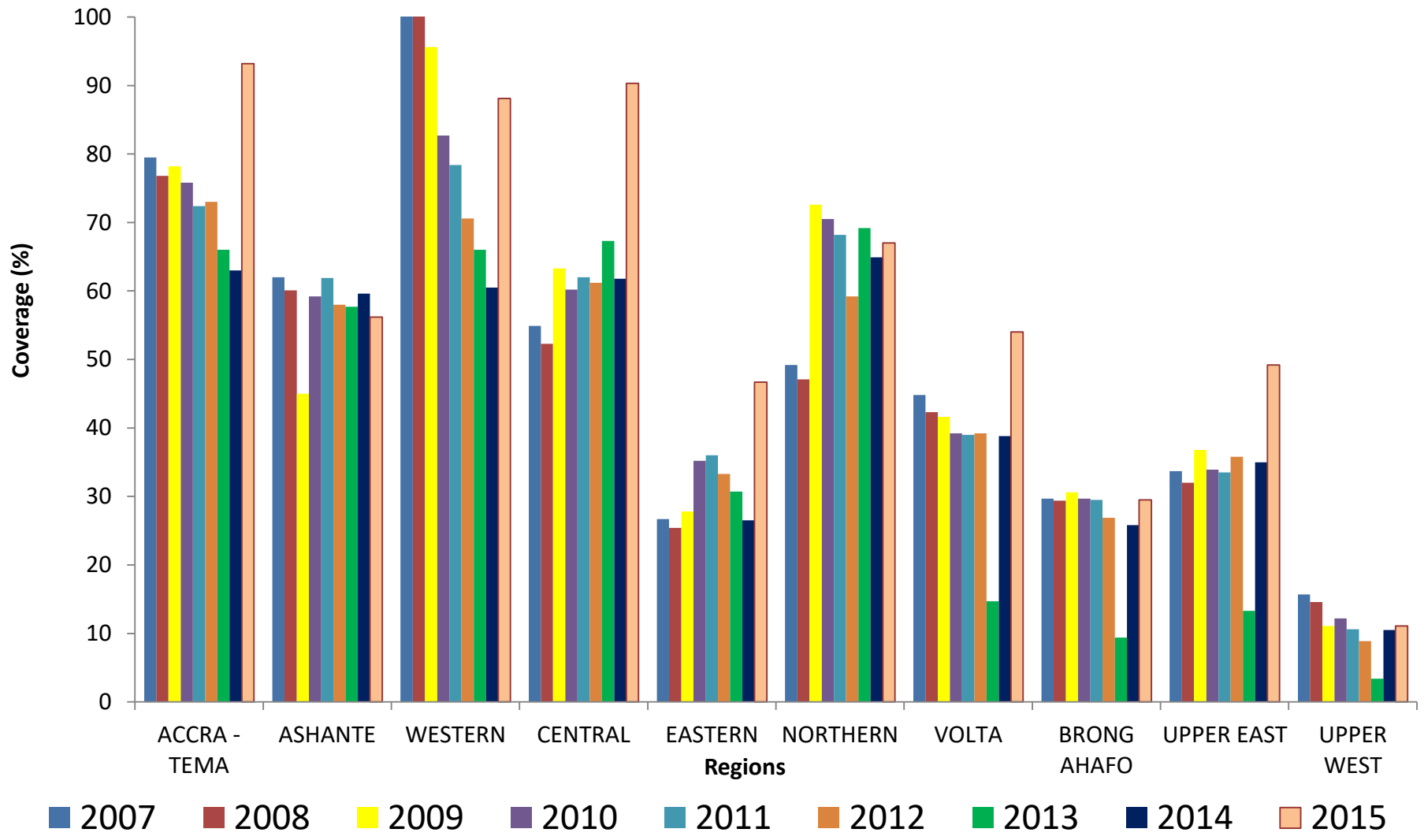
➢ GROUND WATER:
Well, Boreholes, Spring

➢ RAINWATER
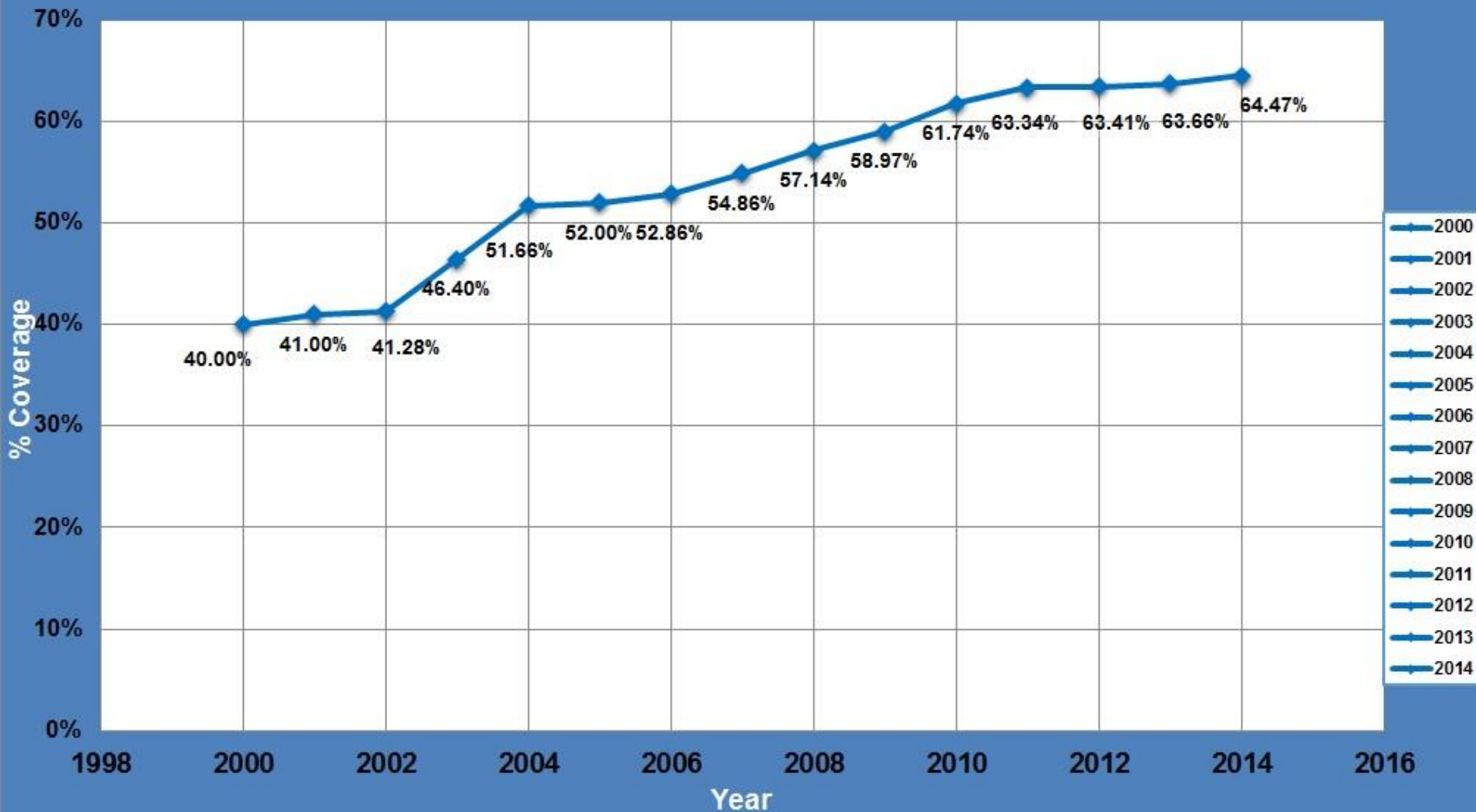
POTABLE WATER

❑ URBAN - GWCL

❑ RURAL   - CWSA

DRINKING WATER SUPPLY AND COVERAGE

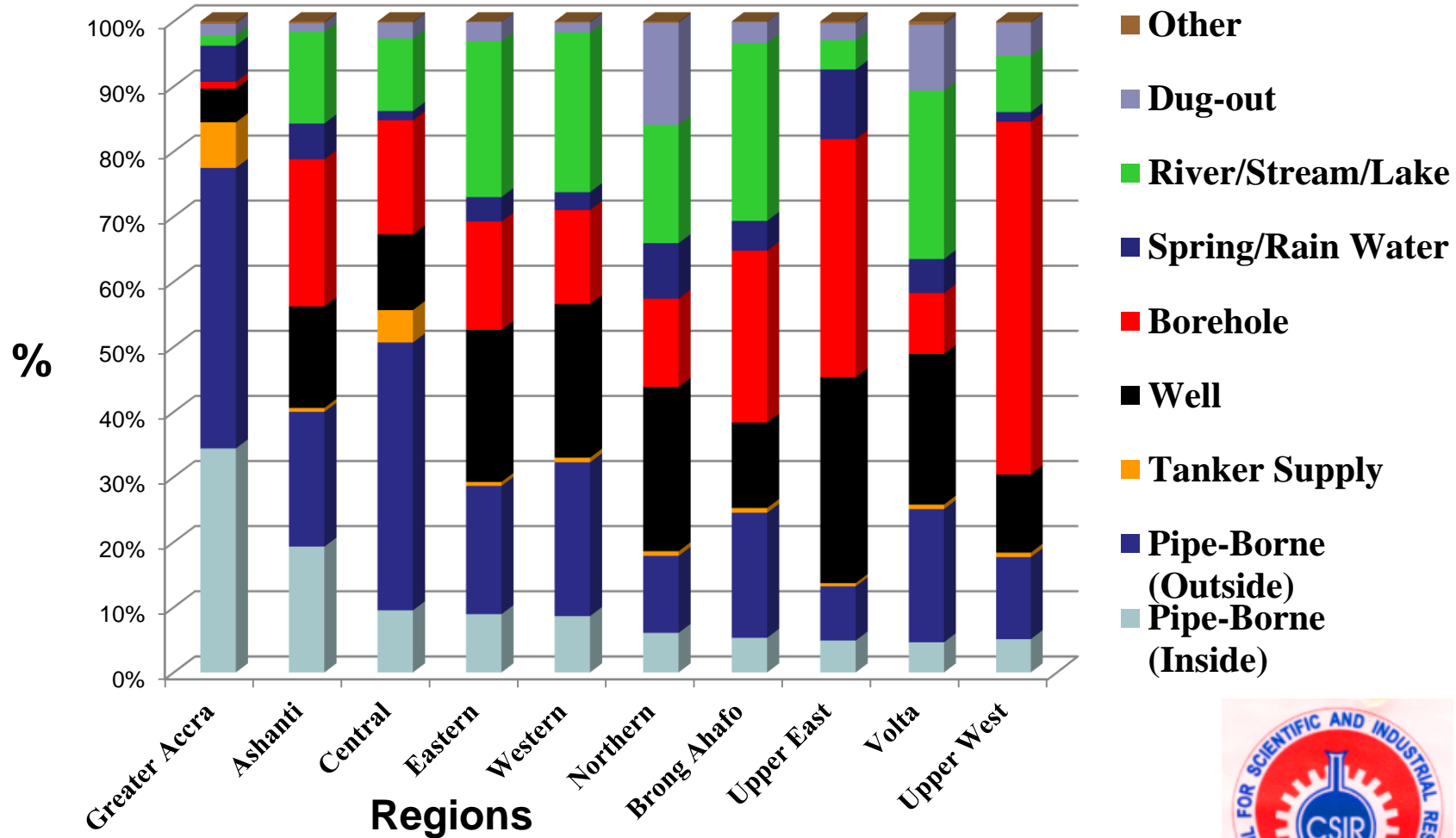GHANA WATER COMPANY LIMITED REGIONAL COVERAGE (2007 – 2015)

SOURCE: CWSA, 2015

MAIN SOURCES OF DRINKING WATER (BY REGIONS)
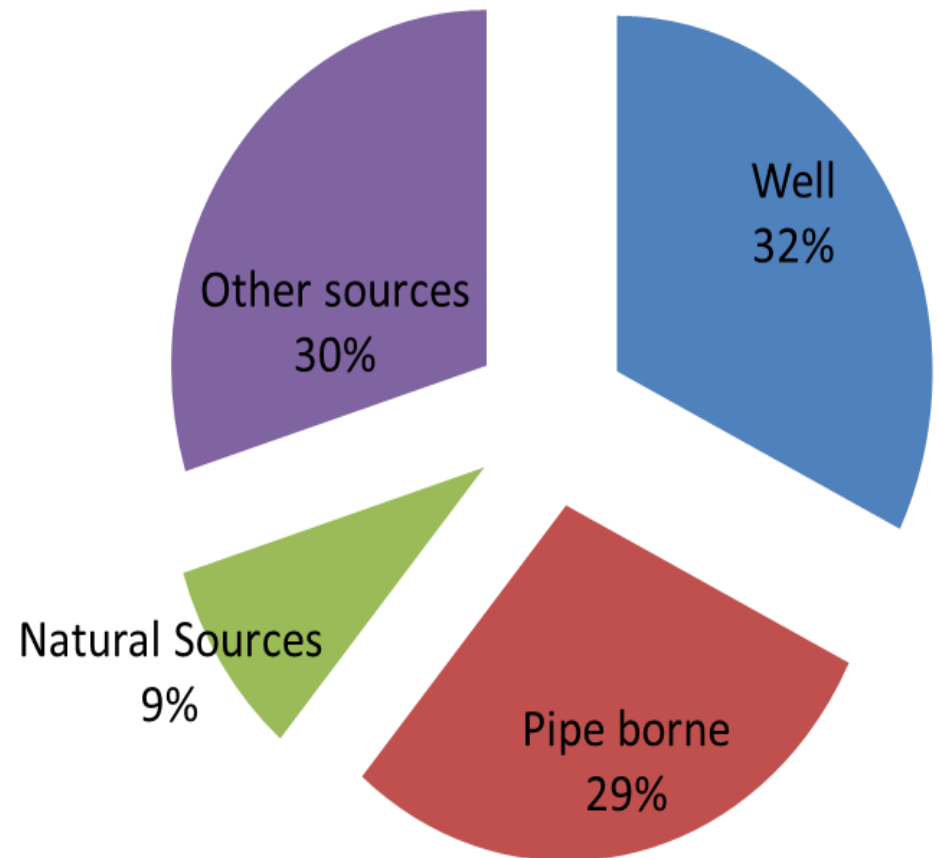

Source: Ansa-Asare, 2016 (Data from GSS, 2010)

MAIN SOURCES OF DRINKING WATER SUPPLY IN GHANA

❖Other sources
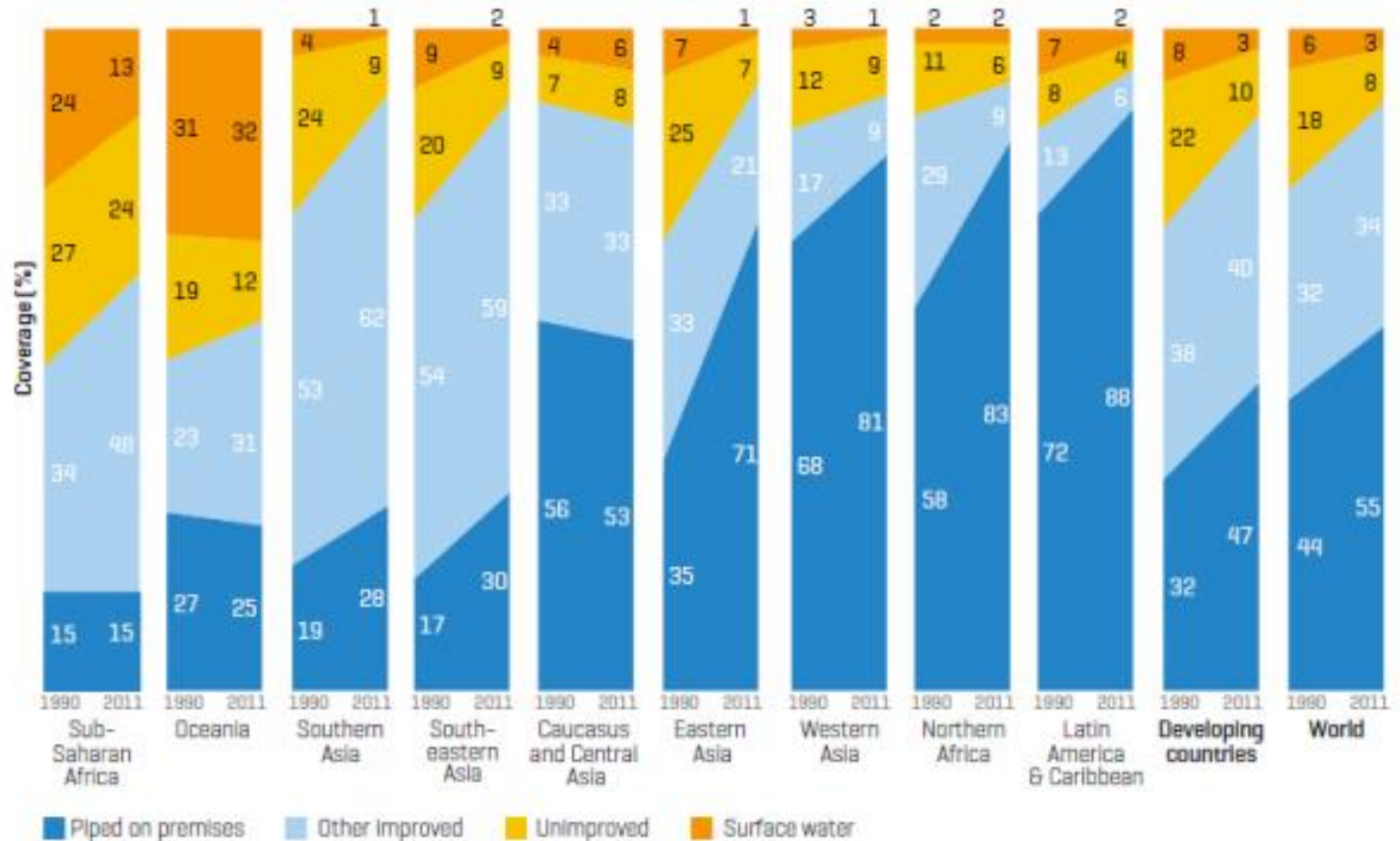Spring, Sachet water, Tanker supply/Vendor

❖Natural Sources
River/ stream, rainwater, dugout/pond/lake/dam/canal

Well 32%
Other sources 30%
Natural Sources 9%
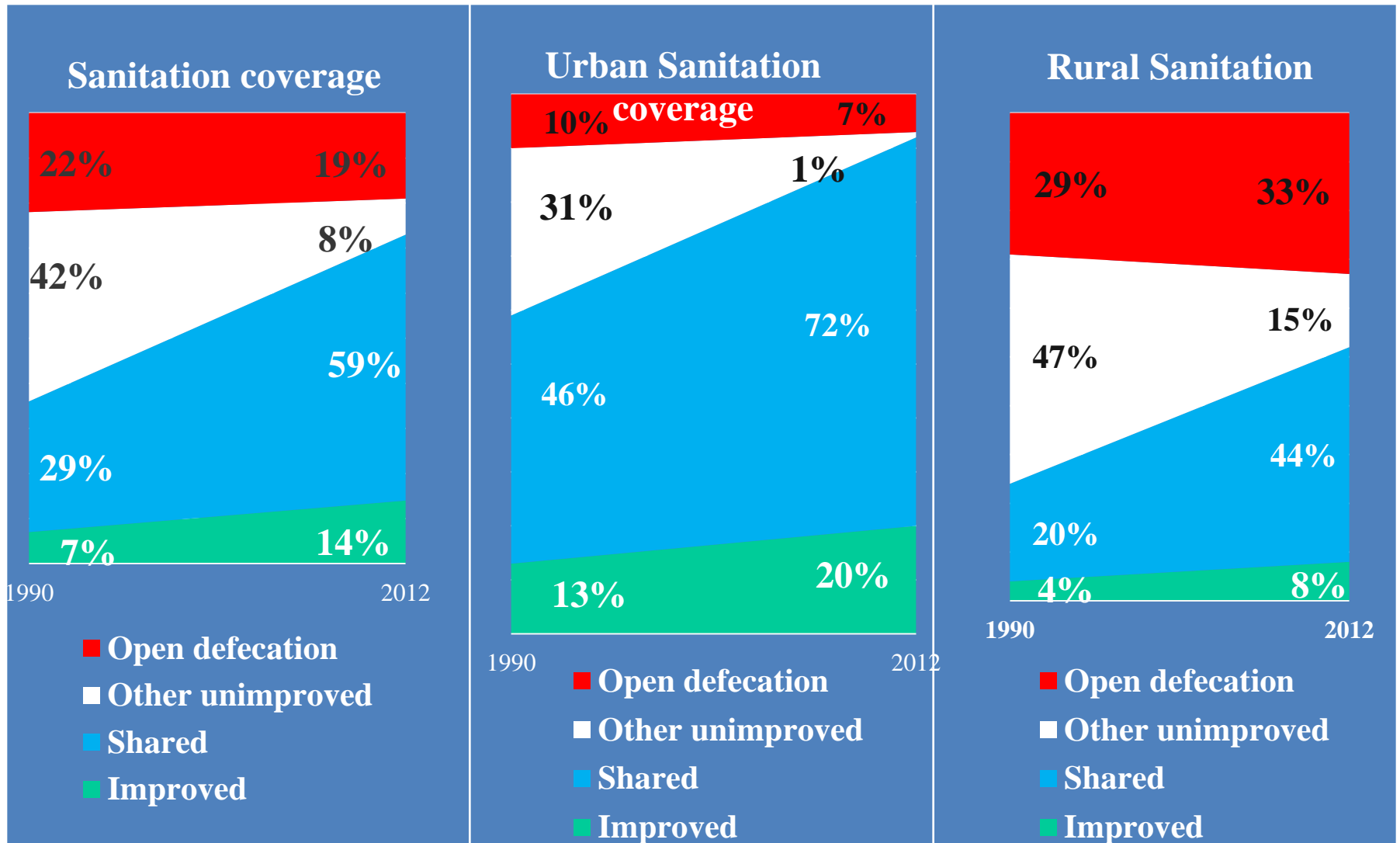Pipe borne 29%

Source: GLSS 6, 2016

SOURCES OF DRINKING WATER WORLDWIDE(1990 -2011)

Sources of drinking water in different regions (WHO & UNICEF 2013)

SANITATION COVERAGE IN GHANA (1990-2012)

Sanitation coverage

22% | 19%
42% | 8%
59%
29%
7% | 14%
1990 | 2012

- Open defecation
- Other unimproved
- Shared
- Improved

Urban Sanitation coverage

10% | 7%
31% | 1%
72%
46%
13% | 20%
1990 | 2012

- Open defecation
- Other unimproved
- Shared
- Improved

Rural Sanitation

29% | 33%
47% | 15%
44%
20%
4% | 8%
1990 | 2012

- Open defecation
- Other unimproved
- Shared
- Improved

WaterAid, 2014

BACTERIOLOGICAL QUALITY (*E.COLI*) OF DRINKING WATER QUALITY

REGIONS	POTABLE (%)	NON POTABLE (%)	NUMBER OF HOUSEHOLDS
WESTERN	45.6	54.4	104,092
CENTRAL	55.2	44.8	78,140
GREATER ACCRA	58.3	41.7	195,775
VOLTA	19.9	80.1	52,131
EASTERN	31.3	68.7	96,202
ASHANTI	32.4	67.6	193,389
BRONG AHAFO	26.4	73.6	60,187
NORTHERN	13.3	86.7	63,491
UPPER EAST	16.1	83.9	30,544
UPPER WEST	27.6	72.4	13,106

BACTERIOLOGICAL QUALITY OF DRINKING WATER (GWCL) IN THREE REGIONS (2012 – 2014)
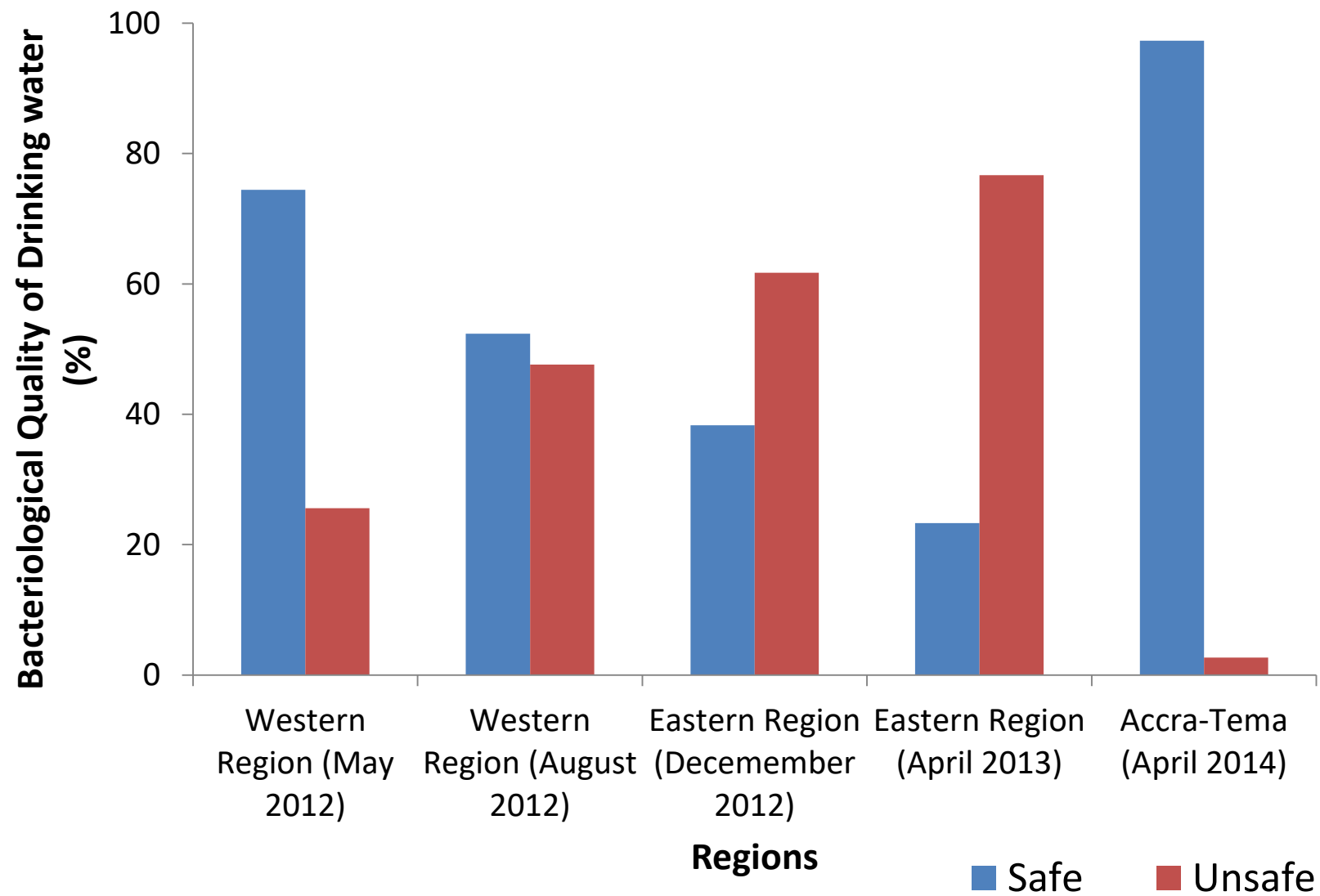
Source: WRI

SOURCES OF CONTAMINATION OF WATER DISTRIBUTION SYSTEM

➢Infiltration of contaminants into the pipe- network

➢Intermittent piped water supply

➢Chlorine decay (low residual chlorine)

CHOLERA CASES IN GHANA

YEAR	CASES	DEATHS
1970 - 1980		1,546
1981 - 1990		2,258
1991 - 1999		1,067
2000 - 2012		627
2011	10,628	105
2012	9,542	100
2013	Few reported cases	Nil
2014	28,975	243
2015	680	10
2016	896	Nil

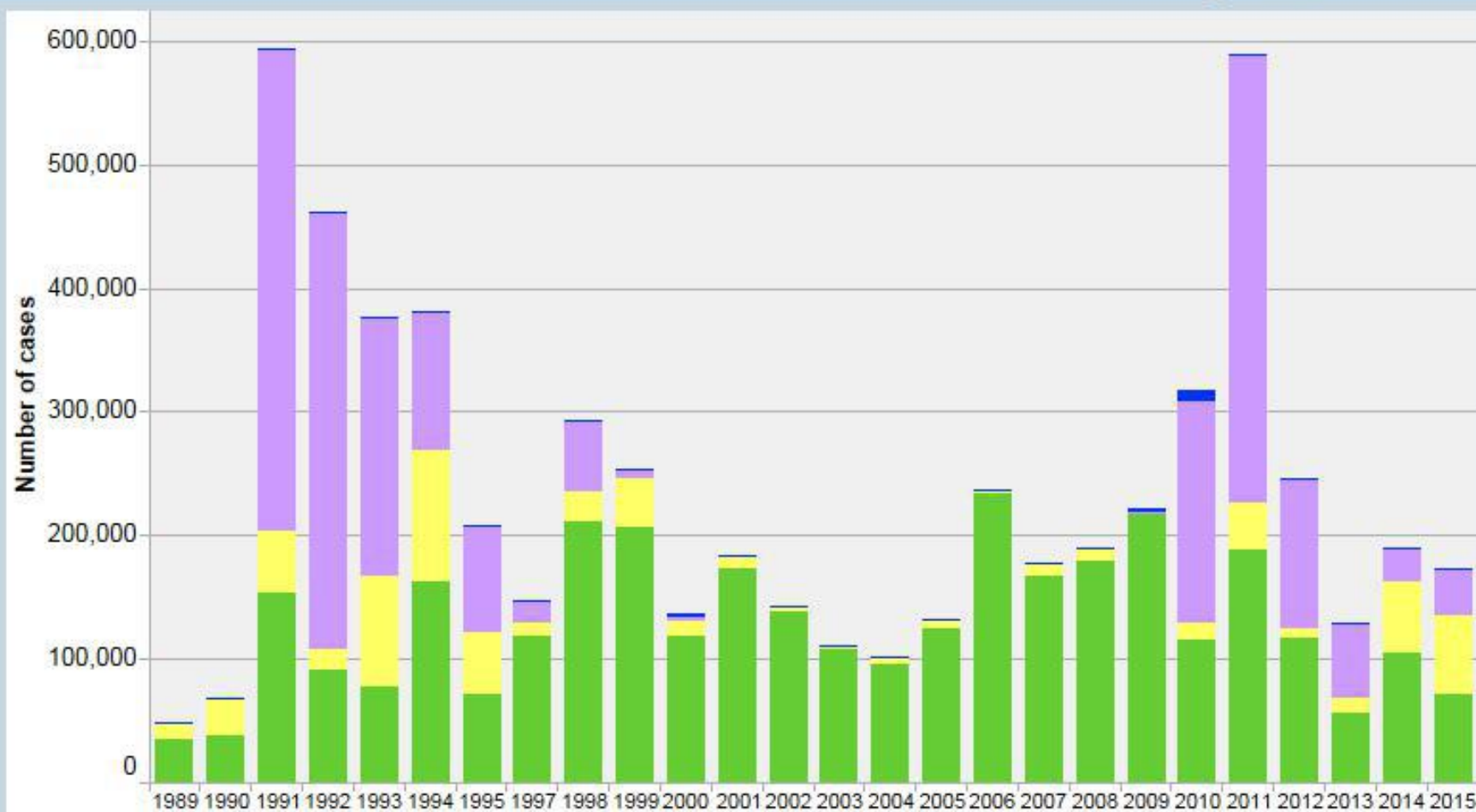➢**Cholera is diarrhoea disease caused by bacteria** *Vibrio cholerae* **from contaminated drinking water .**

Source: WHO, 2015 ; DSU. 2016

CHOLERA CASES IN GHANA-2014
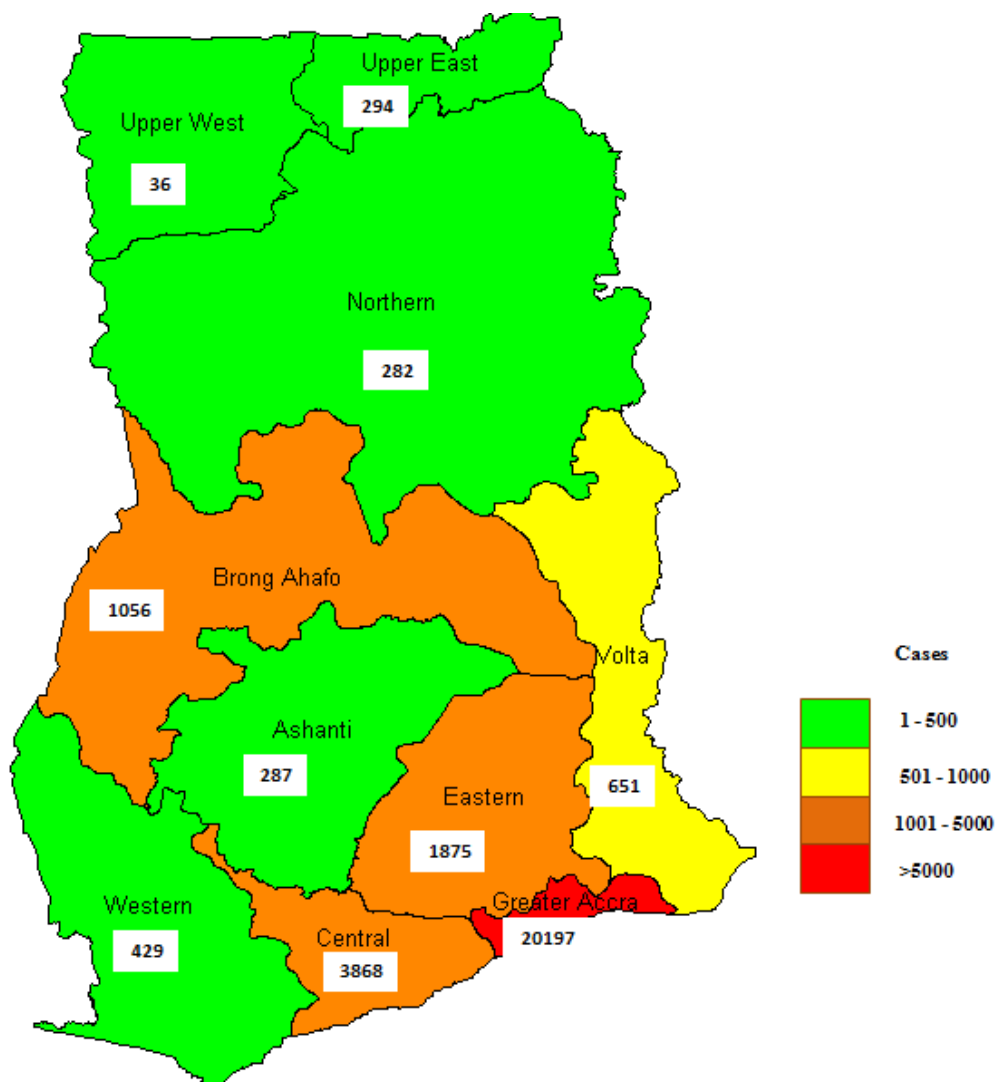
Distribution of cholera cases in Ghana by region, 2014

Cholera cases reported to WHO by year and by continent 1989–2015

Source: Weekly Epidemiological Record, 2016, 91(35)

Legend: Oceania, Americas, Asia, Africa
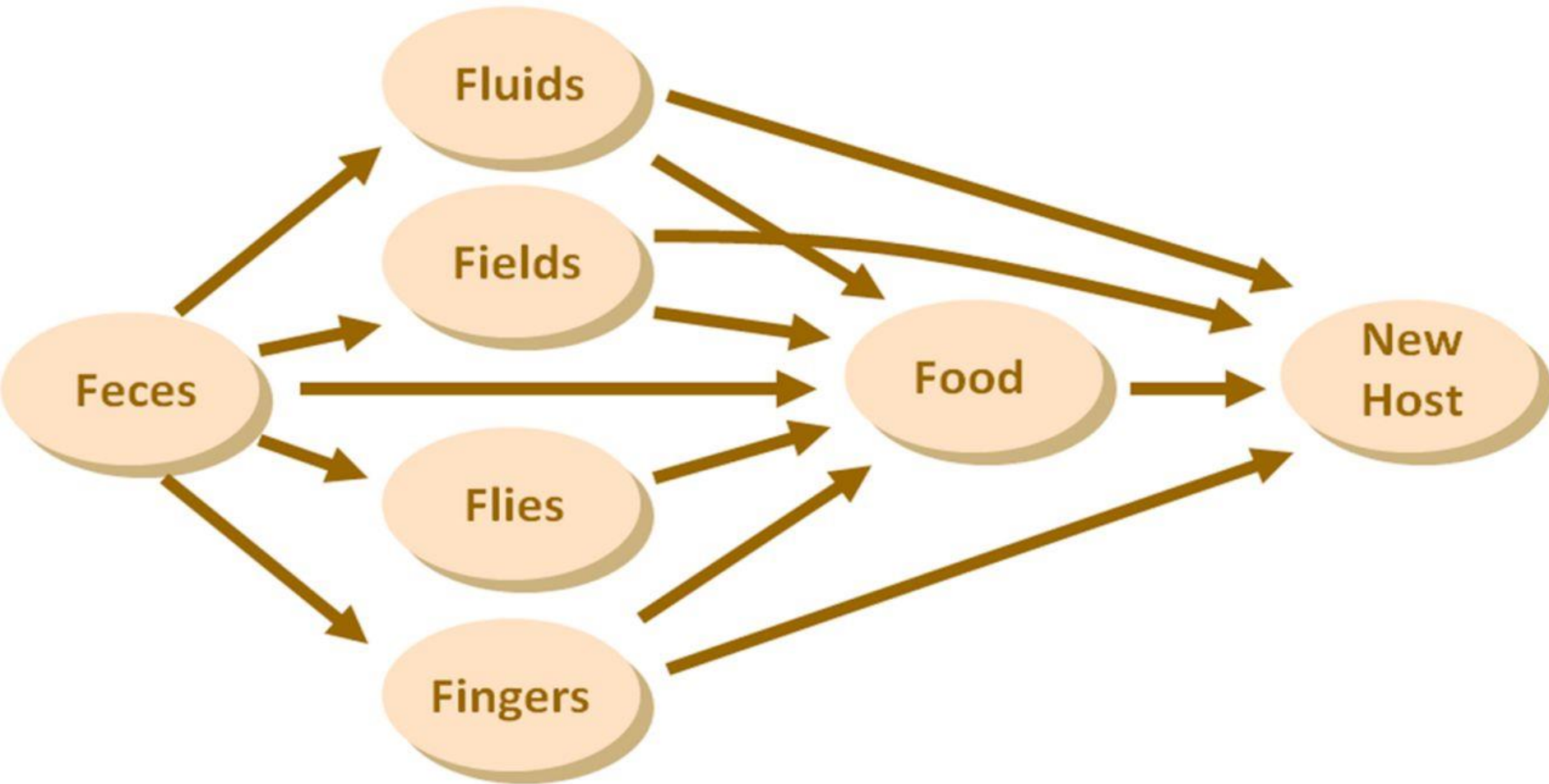
TYPHOID FEVER CASES IN GHANA (2014-2016)

YEAR	CASES	DEATHS
2014	334,103	515
2015	337,120	91
2016	384,454	183

Source: **Disease Surveillance unit of Ghana Health Service, 2016**

➢Typhoid fever is an acute illness associated with fever caused by the *Salmonella typhi* bacteria

FAECAL- ORAL DISEASE TRANSMISSION

The F-Diagram

Source: Wagner and Lanois, 1958

ASSESSING SURFACE WATER QUALITY

- Water quality is assessed in relation to concentrations of the various water quality variables present in the water, whether they are within water quality guideline values.

- Assessment can be by water quality Index (WQI).

- The WQI is a simple means of assessing water quality, by integrating values of key water quality variables into a single number from 0 to 100.

WQI CLASSIFICATION & INTERPRETATION

Class	Range	Description
I	> 80	Good /Unpolluted
II	50 - 80	Fairly good
III	25 - 50	Poor quality
IV	<25	Grossly polluted

MAJOR RIVERS & BASINS – VOLTA RIVER SYSTEMS

Basin	Area km^2
Lower Volta	9,182
Main Volta	168,236
White Volta	49,226
Black Volta	33,302
Daka	8,283
Oti	16,801

Ghana shares the Volta River Basin with Burkina Faso, Togo, Cote d'Ivoire and Mali.

MAJOR RIVERS & BASINS – COASTAL SYSTEMS

Coastal river systems drain 8% of total area of Ghana
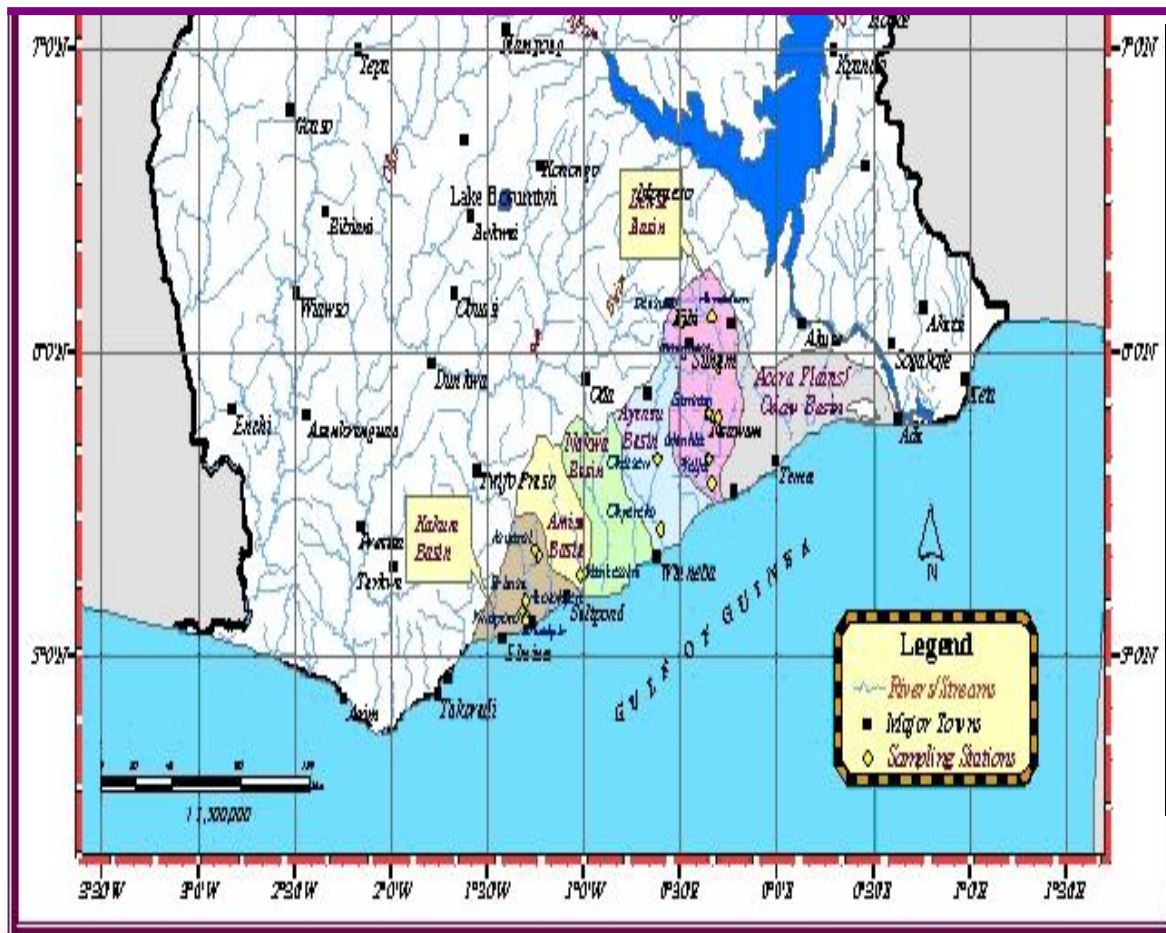
Basin	Area km^2
Kakum	867
Amisa	15,576
Nakwa	1,409
Ayensu	1,709
Densu	2,564
Accra Plains	6,000

Developed and Printed by CSIR-WRI Accra

MAJOR RIVERS & BASINS – SOUTH WEST SYSTEMS

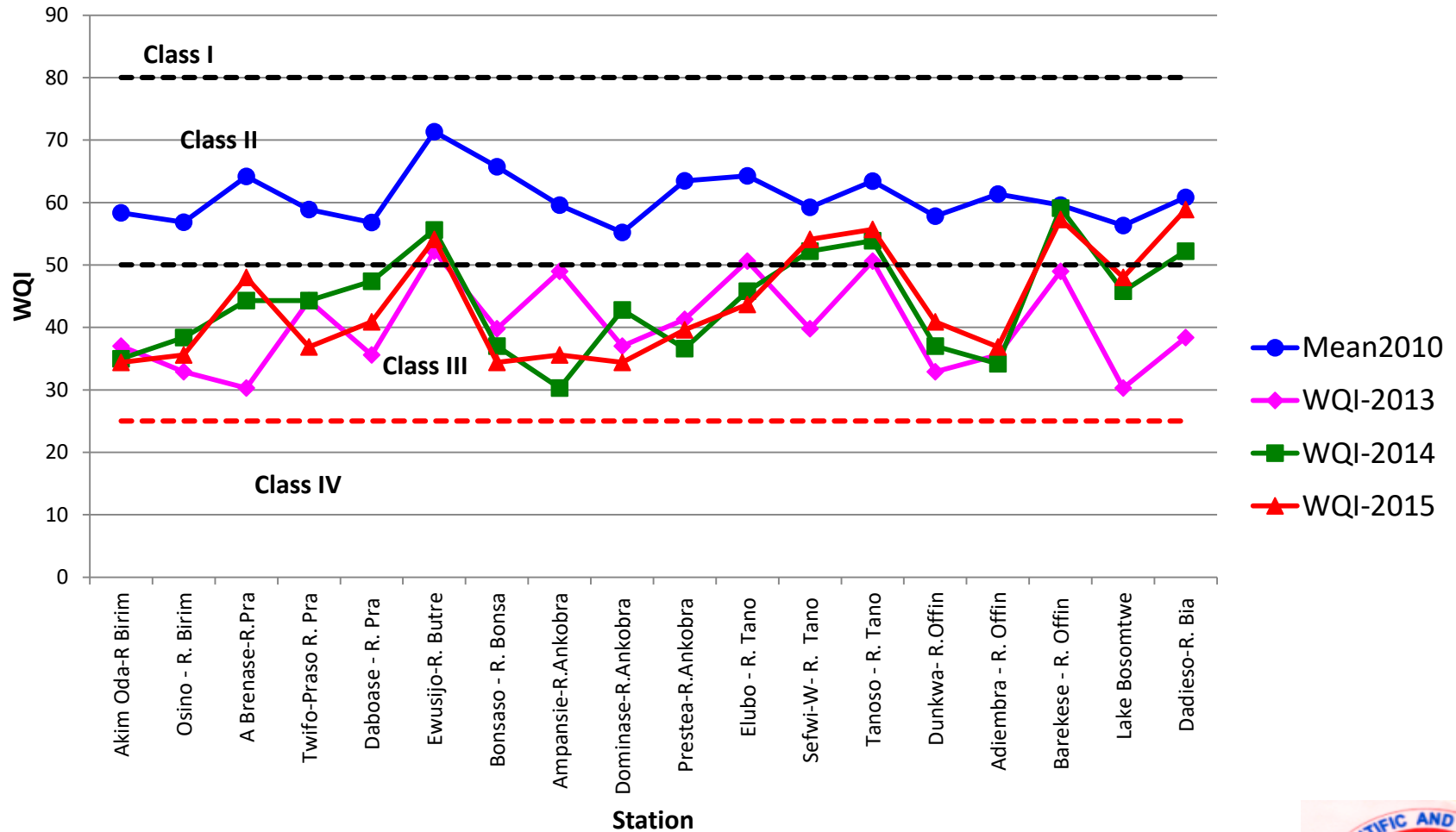Ghana shares the Bia and Tano River Basins with Cote d'Ivoire.
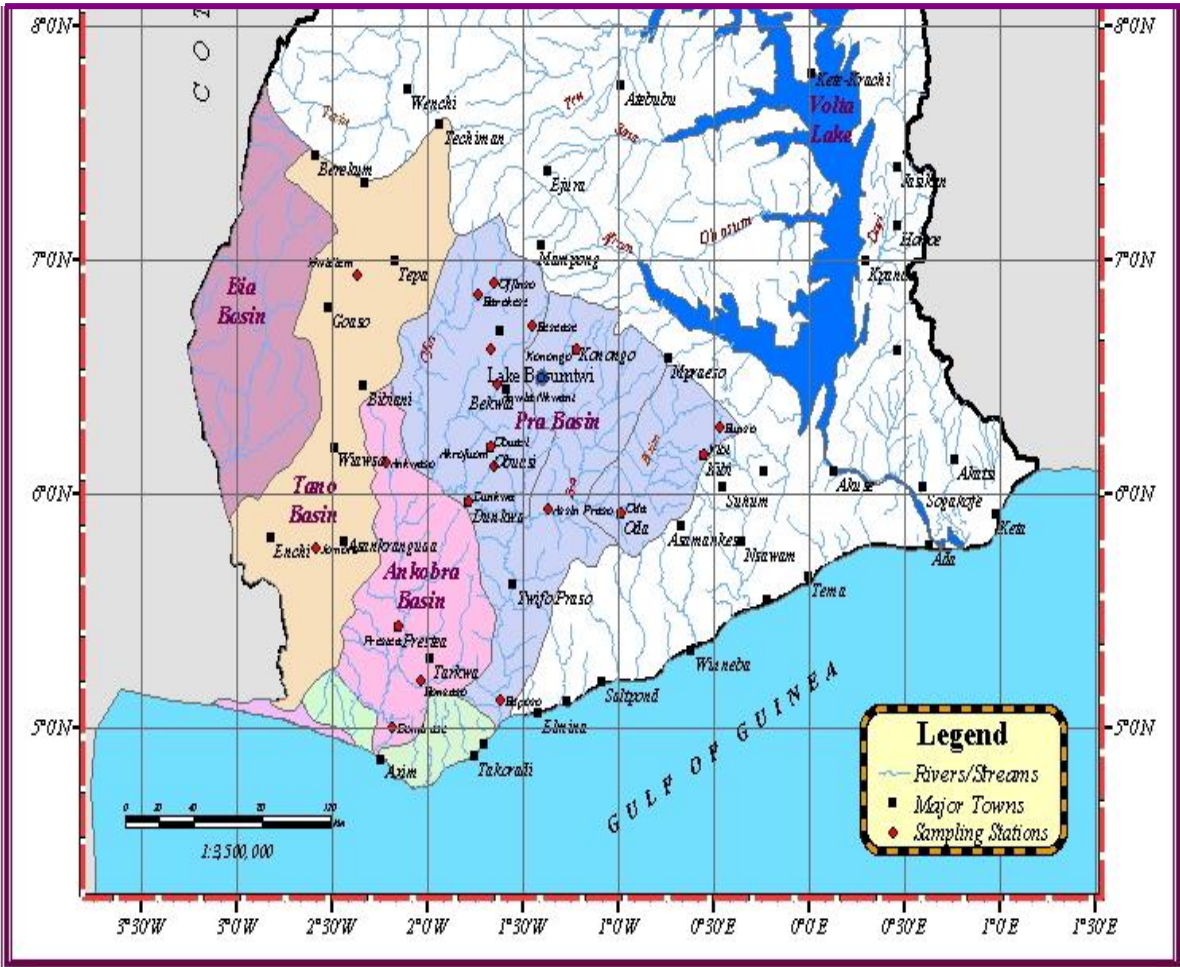
Basin	Area km^2
Bia	6,965
Tano	16,060
Ankrobra	8,366
Pra	23,188

STATE OF SURFACE WATER QUALITY –SOUTH WEST SYSTEM

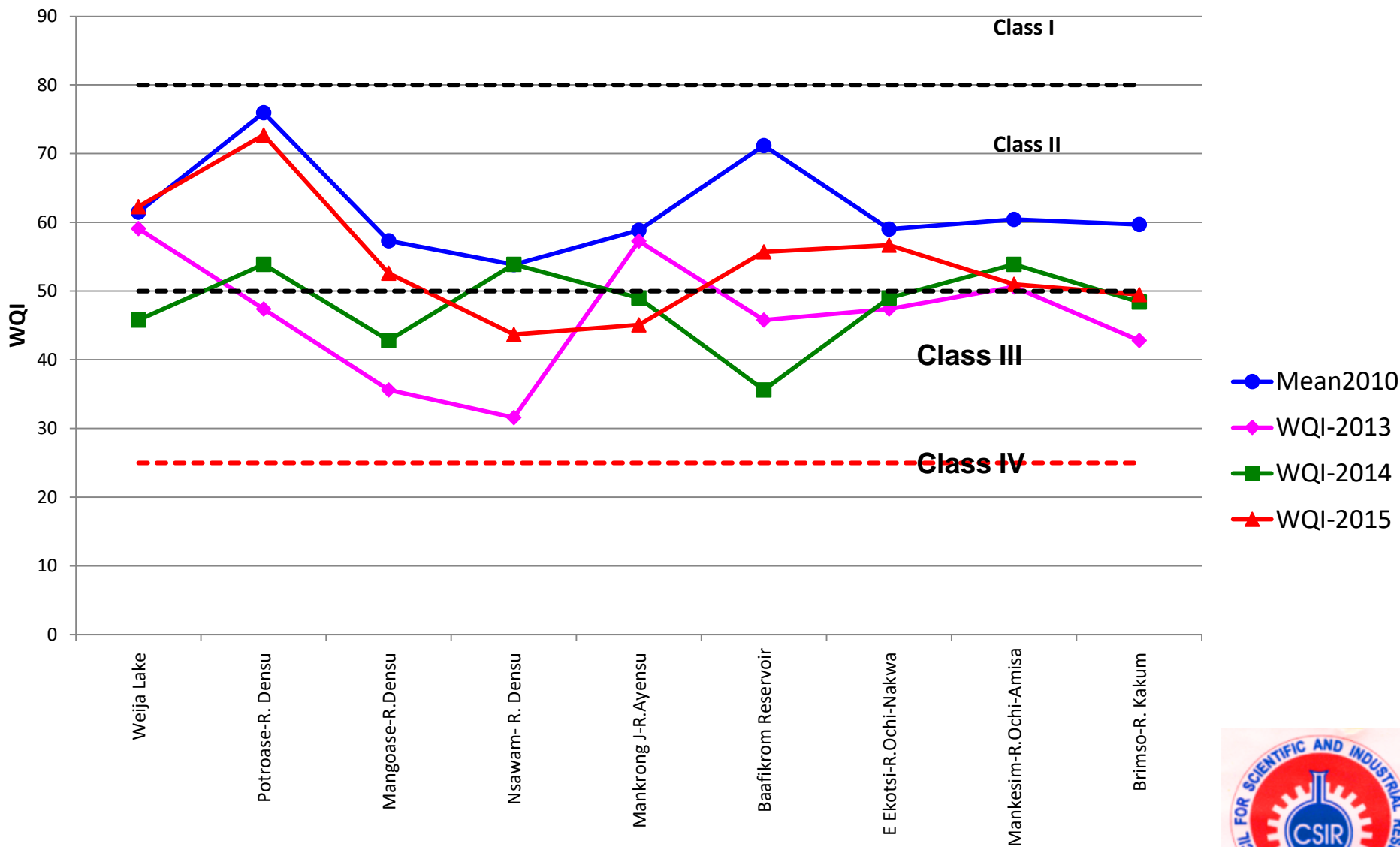Source: Ansa-Asare et al., 2015

STATE OF WATER QUALITY – SOUTH WEST

Pra at Twifo-Praso

Ankobra at Dominase

STATE OF SURFACE WATER QUALITY – COASTAL SYSTEM

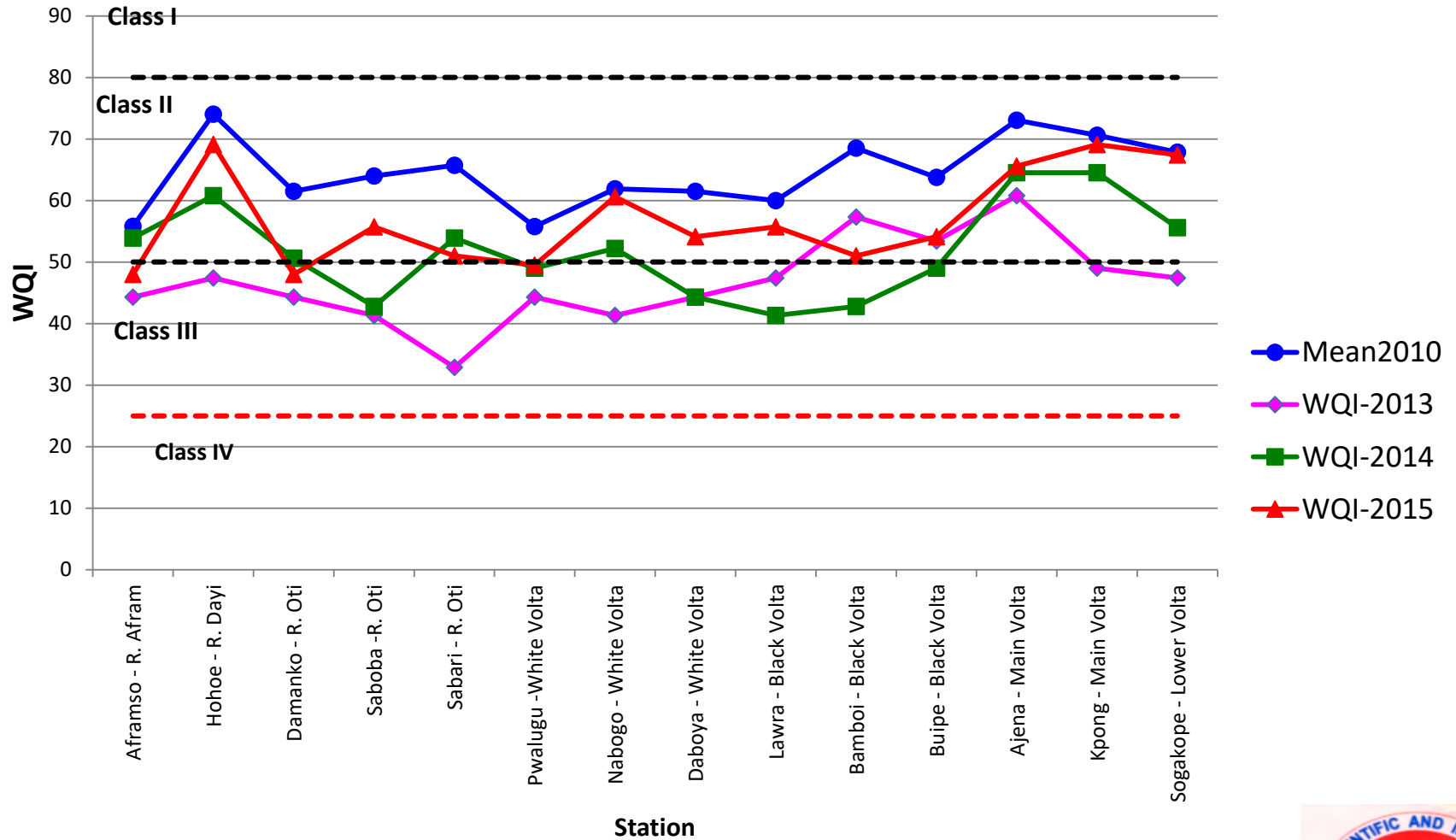Source: Ansa-Asare et al., 2015 Station

STATE OF WATER QUALITY - COASTAL

Kakum at Brimso (Cape Coast)

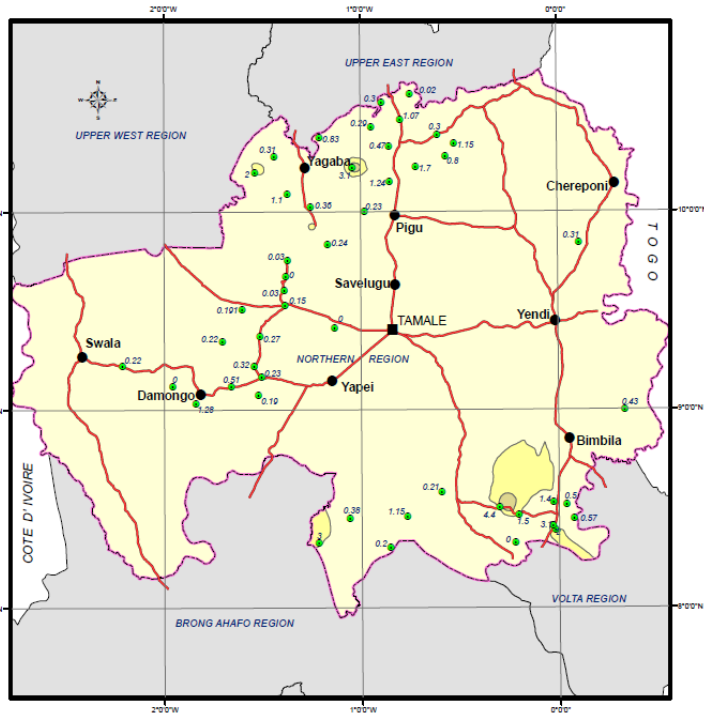**Weija Reservoir, Accra**

STATE OF SURFACE WATER QUALITY- VOLTA RIVER SYSTEM
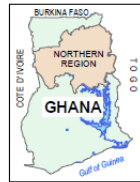
STATE OF WATER QUALITY – VOLTA SYSTEM

Main Volta at Kpong

GROUNDWATER QUALITY (UPPER EAST)

FLUORIDE
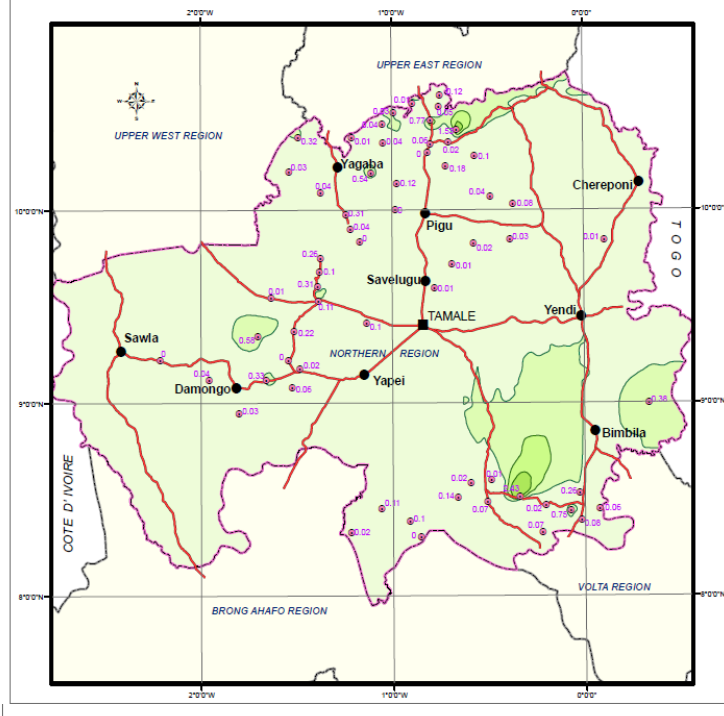
IRON

STATE OF SURFACE WATER QUALITY

- The pollution is attributable to human activities e.g. removal of vegetative cover, illegal mining, fertiliser use etc.

- The decrease in WQ over the years is mainly caused by turbidity, TSS, high nutrients (NO_3-N and PO_4-P), high BOD (Organic matter)

- Highest areas of poor water quality are found in mining and illegal gold mining areas in the southwestern river system.

- Volta system had relatively good quality waters, and less turbid water then the southwestern and the coastal system.

WATER QUALITY MONITORING CHALLENGES

- Budget challenges compromise monitoring objectives
- Discontinuity of monitoring at end of sponsored project
- Gaps in data due to unavailability of funds
- Difficulty in establishing trends
- Difficulty in using data for future predictions
- Resources constraints
- Obsolete laboratory facilities (not state of the art)

SOME CHALLENGES OF DRINKING WATER SUPPLIERS (GWCL)

- High repair works due to pipe burst
- Limited distribution lines
- High level of physical water losses
- High cost of new service connection
- Low capacity utilization for some of the plants
- Low investment

SOME CHALLENGES OF DRINKING WATER SUPPLIERS (CWSA)

- Water quality: High iron (Fe), manganese (Mn), fluoride (F) and salt content in groundwater.

- Spare parts

- Low investment

SOME RECOMMENDATIONS

- Investment in Research and Strengthening of human resource capacity in water and sanitation

- Frequent independent monitoring of drinking water sources and distribution lines

- Education /Dissemination of information on safe water & sanitation

- Extension of distribution networks to all consumers

- Mobilization of new investment for water systems

- Enactment in the building code, requiring all building plans to include rain water harvesting facilities and enforcing it.

- Government should promote partnership between the public and private sectors in the provision of water supply and sanitation services.

THANKS FOR YOUR ATTENTION