


Identification and management of sewage effluent discharges to keep our rivers healthy: Comparative investigations in India and South Australia

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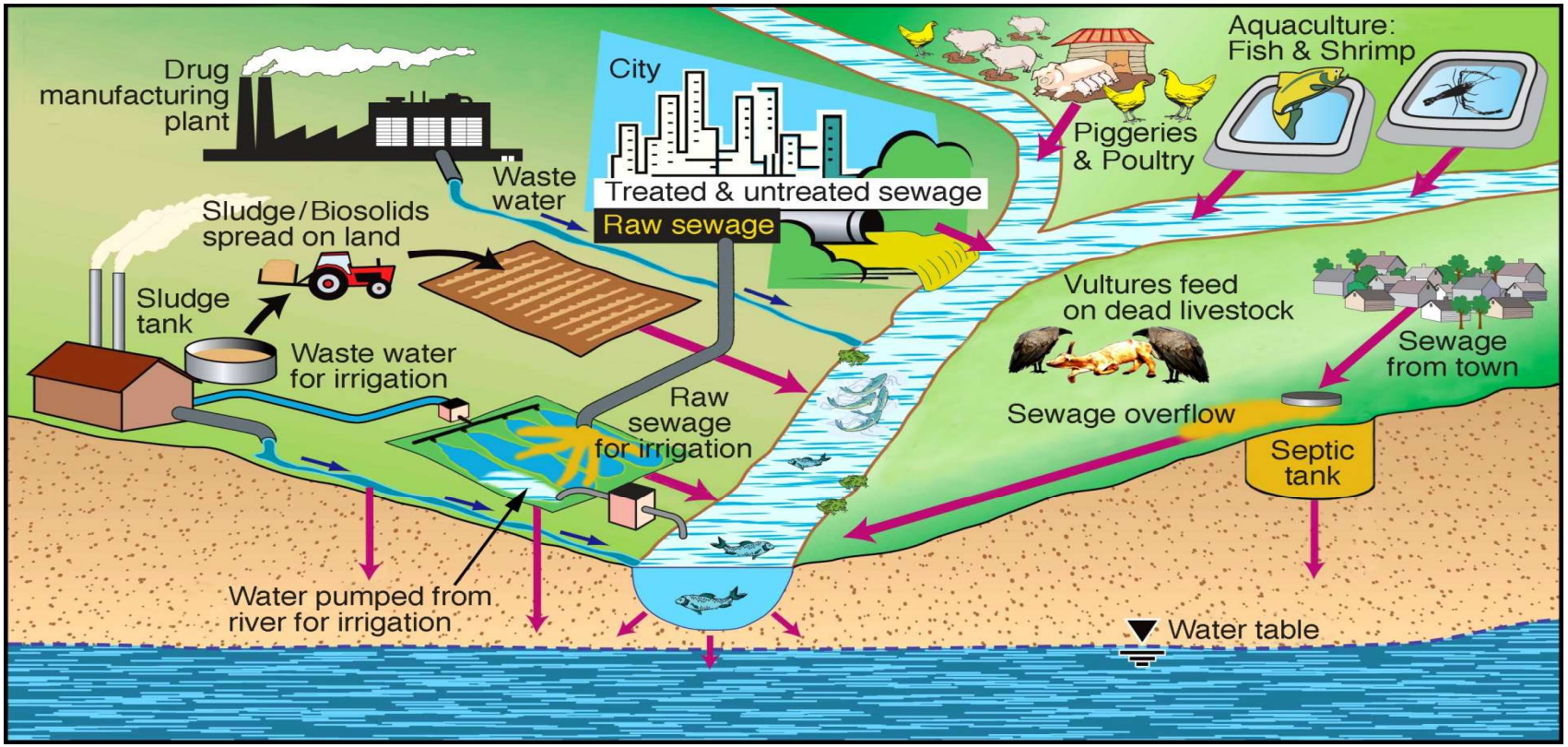
Alok Pandey (CSIR-IITR), Mohana Mudiam (CSIR-IICT) and JK Jena (Fishereis-ICAR)

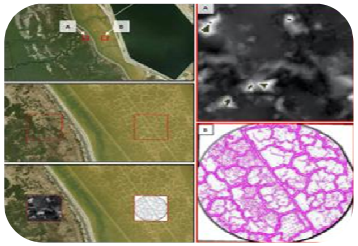
Water carries hidden threats for wildlife…

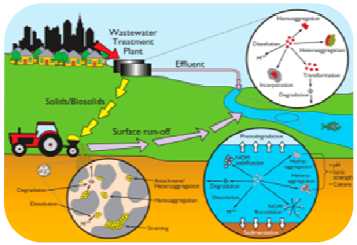


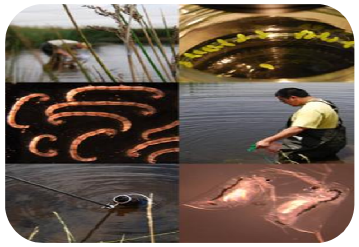
Delivering knowledge and innovation needed for sustainable management of land and water resources

1. Sewage treatment plant- including emerging contaminants
2. Pulp and paper mill effluent
3. Winery wastewater
4. Strom water
5. Textile dyes
6. Cotton, sugarcane and rice growing pesticides
7. Acid mine drainage and acid sulfate soils

Evidence-based policy/guidelines development



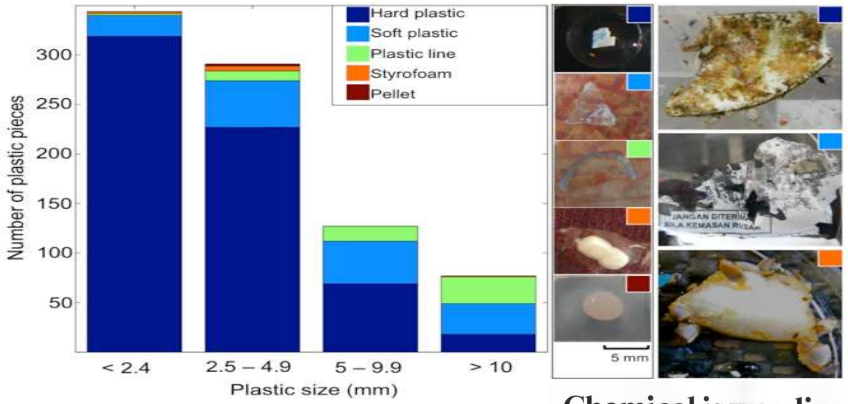




Media reports on water pollution- emerging and legacy contaminants

Australian waters polluted by harmful tiny plastics

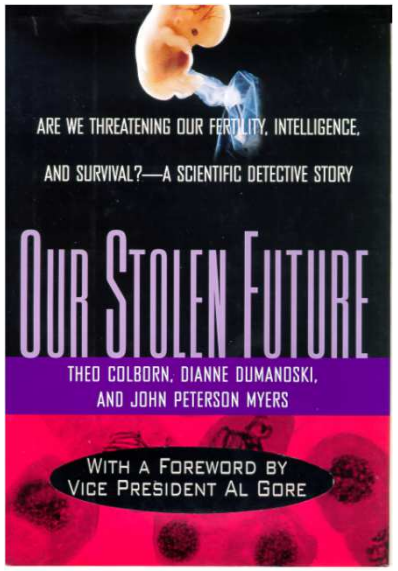
28 November 2013

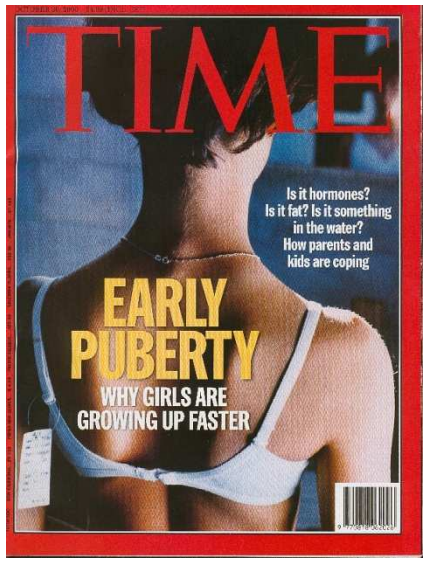


Drugs including painkillers, anti-depressants found in tests on Sydney Harbour water

7 Jul 2015


Chemical is weeding out frogs





Media

More than 60 pesticides banned in other countries in use in India

ROY MATHEW

Six cities along Ganga's banks responsible fo the sewage that empties into river

Vishwa Mohan,TNN | Apr 28, 2015, 03.21 AM IST

READ MORE National Mission For Clean Ganga | Central Pollution Control Board

RELATED

- 118 towns to ensure 500 m area along Ganga becomes a litter-free zone
- Now, Android app to track Ganga pollution
- Study sounds SOS on river pollution
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NEW DELHI: More than half the total sewage discharged int Ganga every day comes from six big cities with Kolkata, Kanp Varanasi leading the pack. They are three of the total 118 tow that fall in the vast basin of the country's national river. The cities which figure at the top are Patna, Allahabad and Morad

Together they present a gigantic task before the government aims to bring these cities to a stage where each drop of sewag they generate can be used by different agencies\sectors inclu industries and municipal bodies after treatment.

The task, under the proposed 'zero discharge policy' of the Ce however, looks much more difficult at a time when more than of the sewage generated in these 118 towns get discharged int Ganga untreated.

A recent report, prepared by a team of experts from different government agencies, has these towns\cities - spread over five states - collectively generate over 3,636 million litre (MLD) of sewage as against the treatment capacity of approximately 1027 MLD.

Underlining the 'gap' between sewage generation and treatment capacity, the water resc Ganga rejuvenation ministry has already asked all five states - Uttarakhand, Uttar Prade

118 towns to ensure 500 m area alon litter-free zone

Vishwa Mohan, TNN | Apr 19, 2015, 05.09AM IST

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NEW DELHI: Urban local bodies in all 118 towns on banks of the river Ganga in five states will maintain the 500 metre area along the river and connecting drains as a 'litter-free zone'. Unemployed youth in these urban areas will be hired to ensure the upkeep of the zone.

Unemployed youth in these urban areas will be hired to ensure the upkeep of the zone.

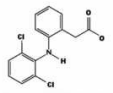
The National Mission for Clean Ganga (NMCG), an autonomous body under the ministry of water resources, will soon enter into a Memorandum of Understanding (MoU) with each of the 118 urban local bodies in this regard and work with the civil authorities to achieve overall objective of rejuvenating the country's national river.

CURBING RIVER POLLUTION

Centre to help urban local bodies of 118 cities\towns in five states

➤ To maintain 500m distance

Diclofenac in Gyps vultures: A molecular mechanism of toxicity



Vinny Naidoo
2007

Department of Paraclinical Sciences
Faculty of Veterinary Science
University of Pretoria
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Efforts In India- “Safe water”

महिला कृषकों को बांटे मास्क

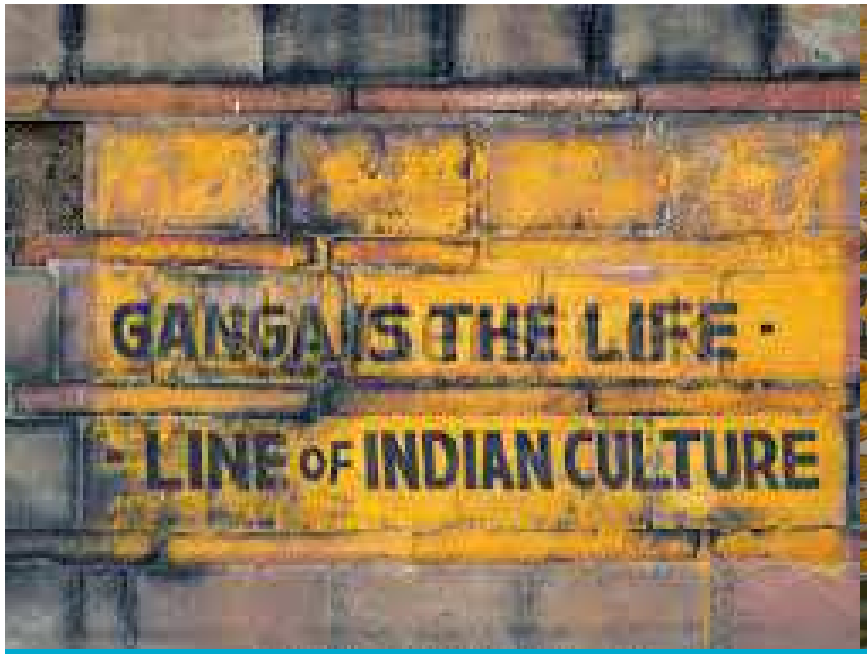
अमर उजाला ब्यूरो

खेकड़ा। ग्राम बसी में आयोजित कार्यशाला में साफ पानी परियोजना विषय पर चर्चा की गई। समाजसेवी संगठन लक्ष्मी जनकल्याण सेवा संस्थान और इंडो ओजेड नेटवर्क के संयुक्त तत्वावधान में स्ट्रेलिया में वरिष्ठ वैज्ञानिक डॉ. अनु कुमार और राष्ट्रीय स्मेकित नाशीजीवी प्रबंधन केंद्र की प्रधान वैज्ञानिक डा. सुमित्रा अरोड़ा, कृषि विज्ञान केंद्र की वैज्ञानिक डॉ. सरिता जोशी, डॉ. संजय कुमार ने संबोधित किया। व्याख्यान में साफ पानी एवं कीटनाशकों के सुरक्षित उपयोग के बारे में बताया। महिलाओं को

गांव बसी में आयोजित कार्यक्रम में मौजूद कृषक महिलाएं।

कीटनाशकों के छिड़काव के लिए मुंह पर पहनने वाले सुरक्षा मास्क वितरित किए। इस दौरान स्थान की सचिव नीलम त्यागी, शोकेंद्र, अरविंद कुमार, विशाल आदि मौजूद रहे।

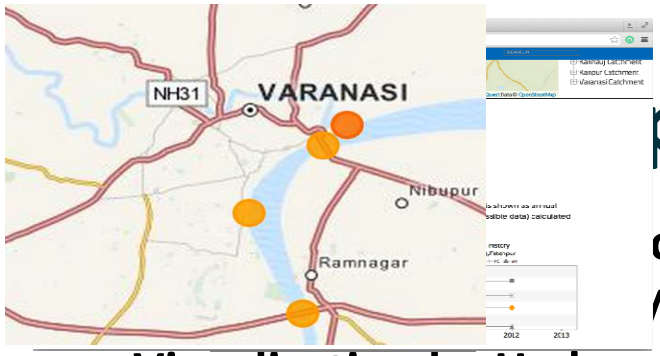
280 rural women and 150 children
50 academics through hands-on training over workshops over 12 days
Exchange visits of scientists and joint publications




Score card approach- The Ganga River Development of framework

LAND AND WATER BUSINESS UNIT
www.csiro.au

Australian Government
Department of Foreign Affairs and Trade



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cal parameters

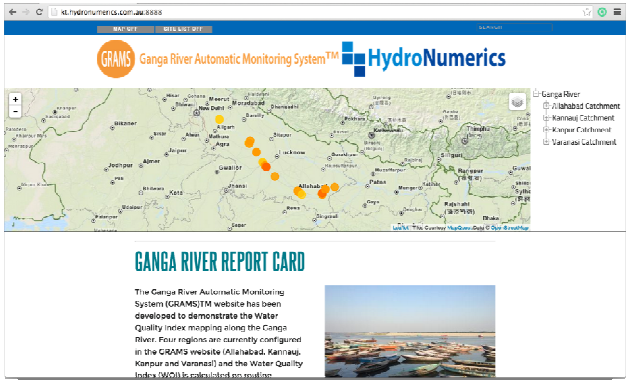
ICG

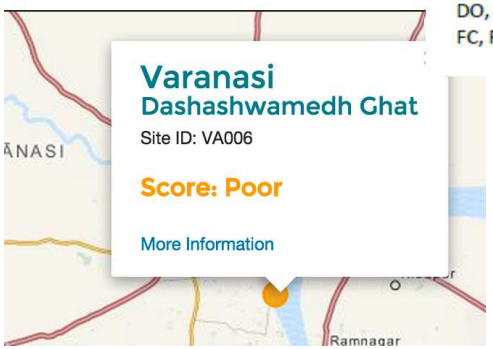
Visualisation by Hydronumerics

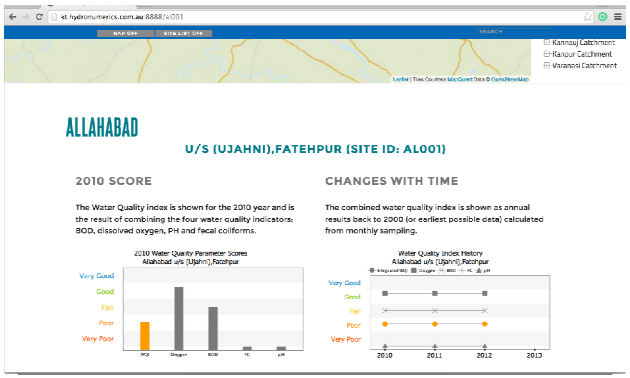
Fair to Poor- Water quality

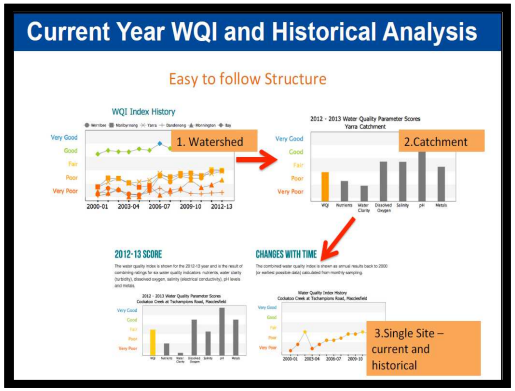
Status	DO	BOD	pH		FC
Excellent (5)	>10	<2	6.6 - 7.5		≤10
Good (4)	8.5-10	2 - 3	6.2 - 6.6	7.5 - 7.9	>10 - 100
Fair (3)	7 - 8.5	3 - 7	5 - 6.2	7.9 - 9	>100 - 1000
Poor (2)	4 - 7	7 - 9	3 - 5	9 - 11	>1000 - 10000
Very poor (1)	<4	>9	<3 and >11		>10000

DO, Dissolved Oxygen (mg/L); BOD, Biochemical Oxygen Demand (mg/L); FC, Faecal Coliform count, (MPN/100 mL)









Score card based on Water quality index

The Vision for Ganga Rejuvenation constitutes restoring the wholesomeness of the river defined in terms of ensuring “Aviral Dhara” (continuous flow), “Nirmal Dhara”(unpolluted flow), and geologic and ecological integrity.

Organisation of workshop in Sep 2015 with representatives from NMCG, CWC, IITR, NBFGR, WWF and CSIRO

LAND AND WATER

A Scorecard system to track pollution and improve water quality in the River Ganga

The River Ganga is used by millions of people every day, but the quality of its water is under threat from a range of domestic and industrial pollutants. This project undertook to develop a water quality assessment framework that could be applied at key locations along the river and incorporated into an easy-to-understand scorecard. This scorecard will provide accurate, up-to-date information to help regulators, industry and domestic users of the river to appropriately manage water quality in the Ganga Basin.

What's in our water?

A composite water quality index for the River Ganga

Designing a water quality scorecard

Metal Pollution

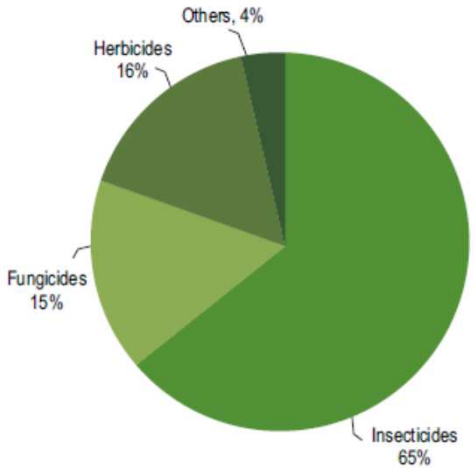
- The pollution of aquatic environment by heavy metals has assumed serious proportions due to their toxicity and accumulative behavior.
- Heavy metals added to an aquatic system by natural and anthropogenic sources during their transport are distributed between different compartments of aquatic ecosystems, such as water, sediment and biota.
- Lead, chromium, cadmium, zinc and copper above WHO drinking water and ecosystem health guidelines even in **Haridwar**
- Tyagi (NEER) said “a large number of villagers were suffering from stomach ailments, brain disorders and even cancer”

Pesticide issues – India and Australia

Detection organochlorines in Ganga Basin

Mutiyar and Mittal, 2013

Pesticide use in India mainly Insecticides



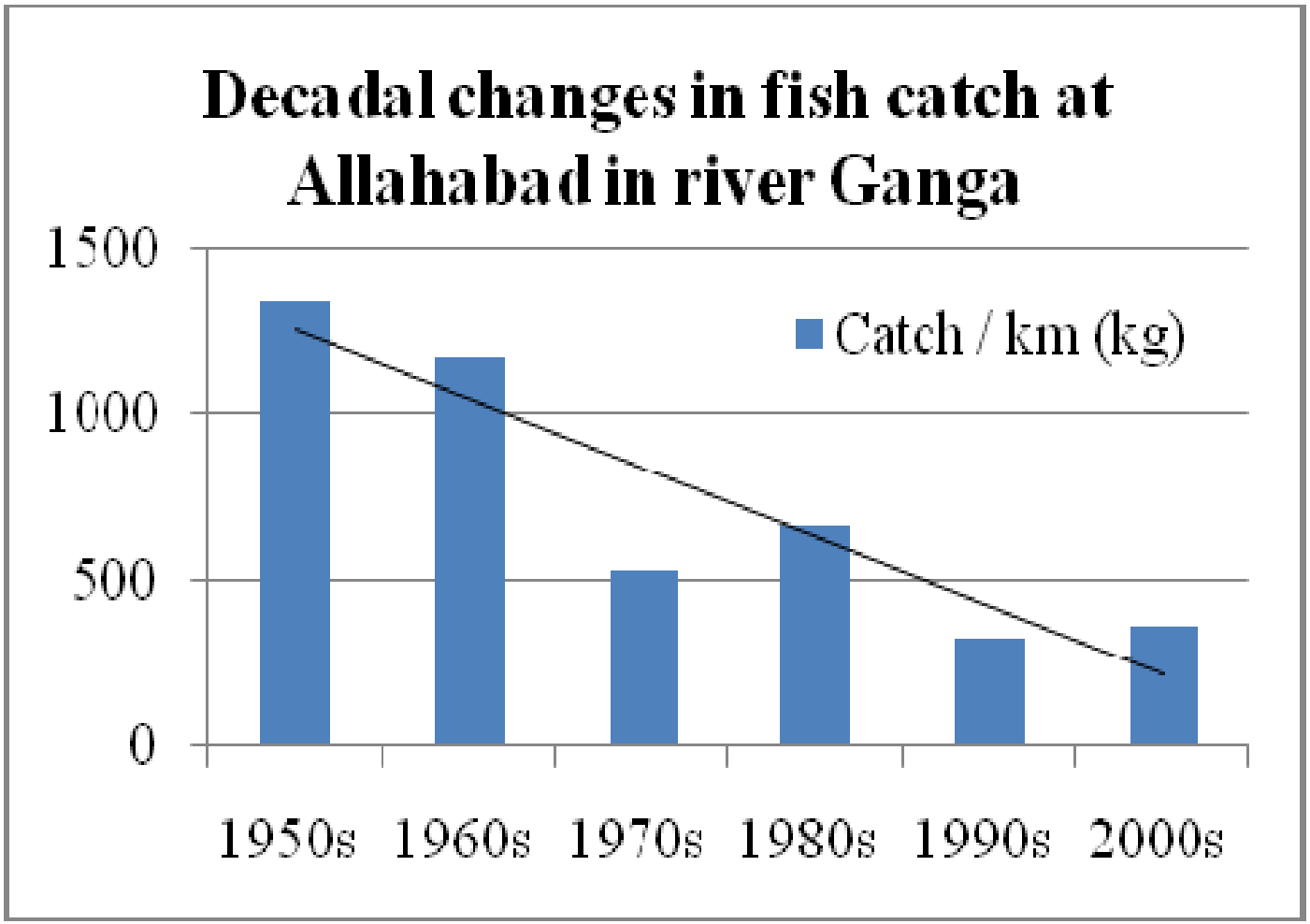
Source: Industry reports, Analysis by Tata Strategic

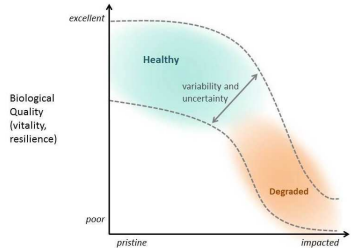
Banned pesticides in EU are still used in Australia.

Broad-spectrum pesticides are some of the cheapest chemicals in Australia costing only A$1.50 per hectare

Pesticides running into the Great Barrier Reef

"Pesticides are silent killers; they can't be seen in reef waters, but we know they are there".





Source: CIFRI, Allahabad

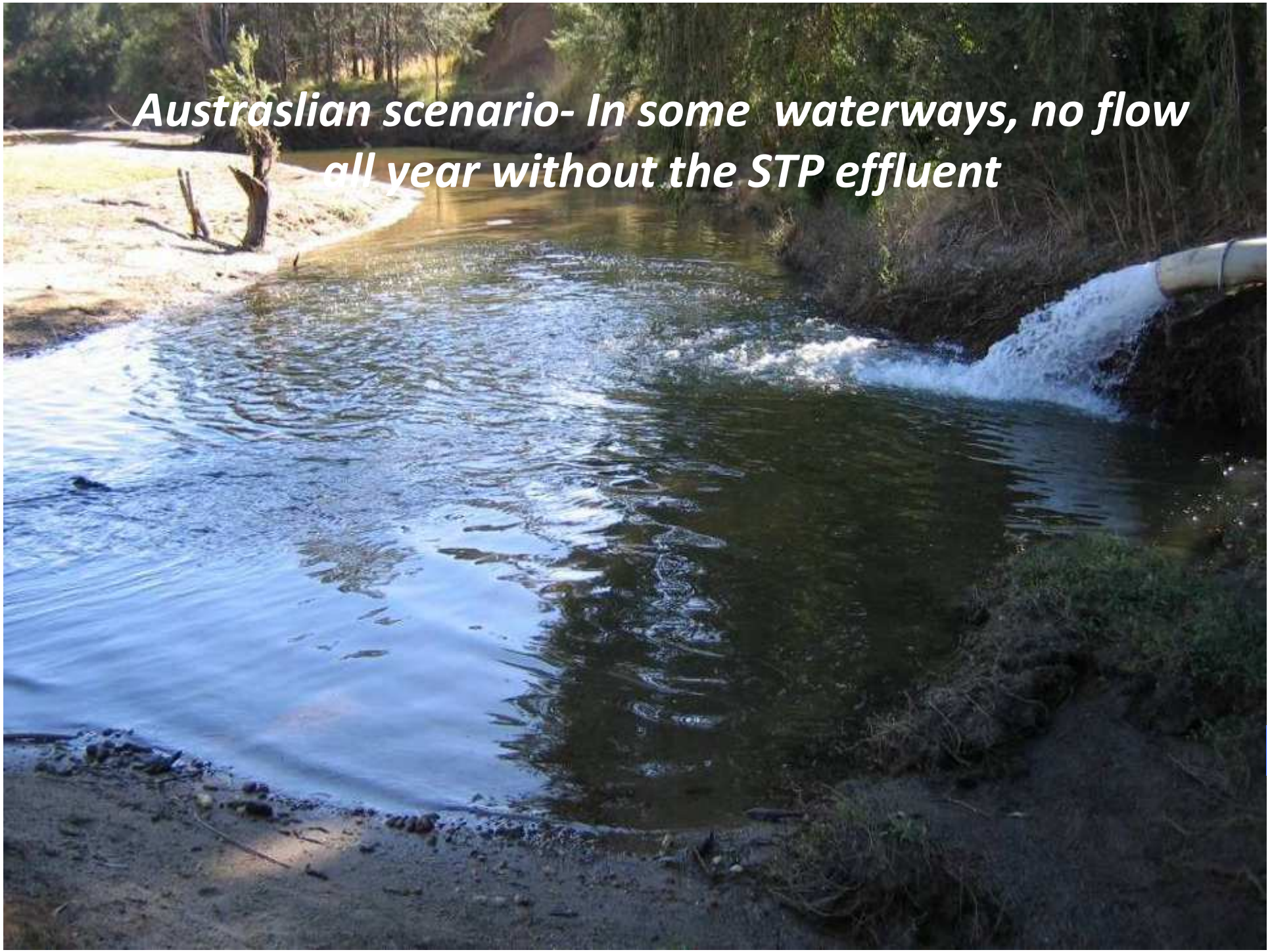
Source: CIFRI, Allahabad

Potential indicators for future score card

- Include contaminants such as **heavy metals, pesticides** and emerging contaminants
- **Toxicity** can provide information on the cumulative impact of **sources of contamination** and is recommended for inclusion in both- river and drain score cards.
- **Biodiversity** as an indicator of river health is more suitable for the river score card.
- ***Social and cultural and Economic aspects*** are also critical

AISRF Funded project

Collaboration between IITR, IICT, NBFGR and CSIRO


Austraslian scenario- In some waterways, no flow all year without the STP effluent

For better understanding info required:

1. Occurrence
2. Sources and Source Pathways
3. Transport and Fate
4. Ecological Effects

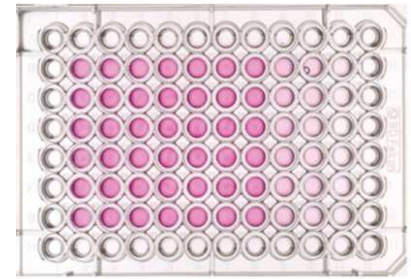
Project objectives and methodology

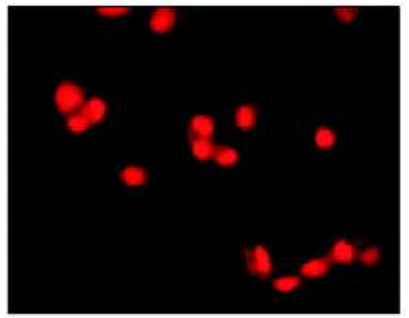
- **A risk-based approach combining both biological and chemical assessment to identify and determine the impact of selected micropollutants discharged via sewage effluent into Indian and Australian rivers**
- **Sampled 14 sites (drains, upstream and down stream locations) in Allahabad and Varanasi.**
- **Sampled 12 sites in South Australia**

Application for river and effluent monitoring

- A battery of *in vitro* tests can provide very good estimates of river water quality and effluent quality:

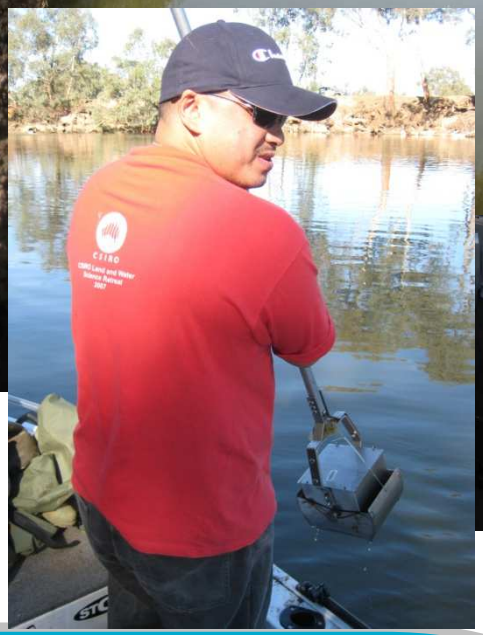
Non-specific/specific cytotoxicity	Cell lines: liver-derived; immune system cells; intestinal epithelial
Endocrine activity/disruption	BDS CALUX, E-Screen, MCF-7 etc.
Reactive toxicity	Genotoxicity, i.e. DNA damage (comet assay, micronucleus formation)
Adaptive stress responses	e.g. Oxidative stress responses, compensatory mechanisms (AREc32)





- **R**eplacement, **r**eduction, **r**efinement of animal testing

Longitudinal Sampling of Water and Sediment in Australia



Upstream
Outfall
Downstream (10, 50, 100, and 1000 m)

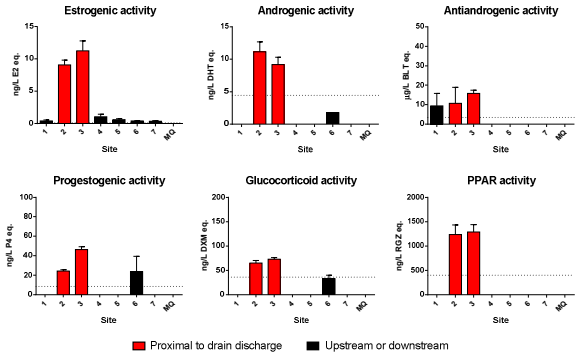
Results so far- Australia

- EDCs detected at low concentrations
- Pharmaceuticals were also detected but at much lower concentrations than in comparison to Indian sites.
- Fish caging studies suggest low risk to environment- tertiary treated STP discharges into river
- Rural STP had higher EDC levels- potential risk to the environment

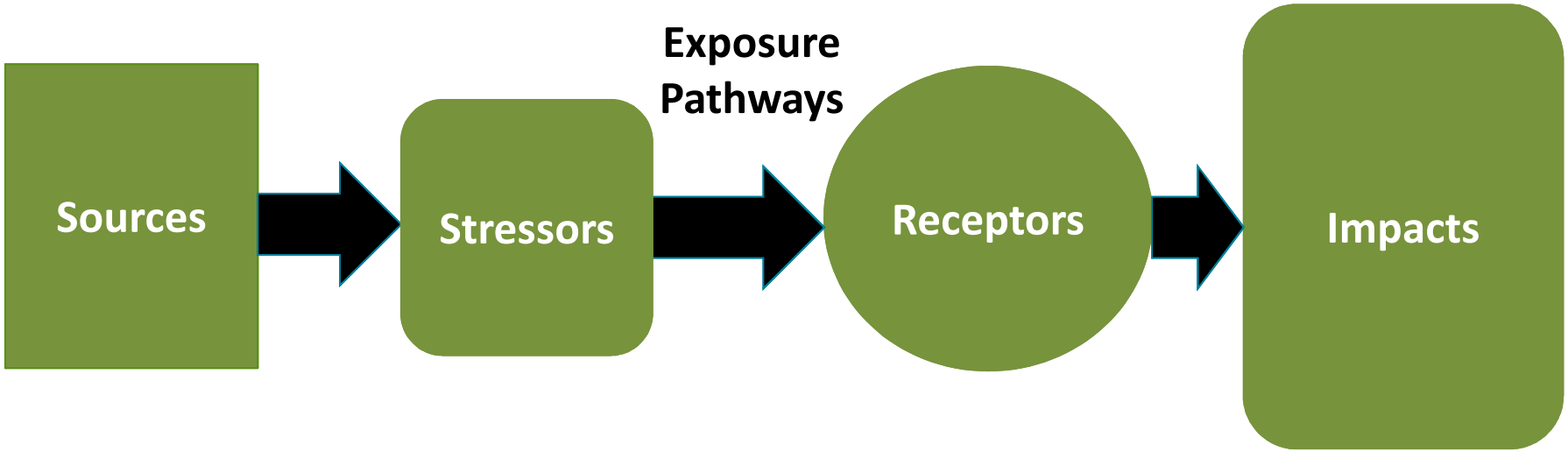
Allahabad and Varanasi

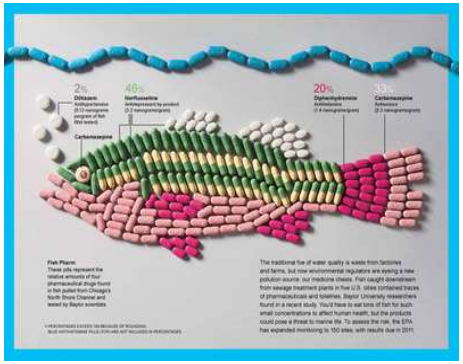
- Detection of pesticides including pyrethroids and organophosphate pesticides.
- Concentration greater in drains in comparison to the river upstream and downstream locations.
- Metals detected in the drains and river water
- Some metals above ecosystem and WHO drinking guidelines.
- Endocrine disrupting chemicals detected including pharmaceuticals and plastics

What does it mean?
Are these threatening fish species and biota in the river?
Fish caging studies are planned.



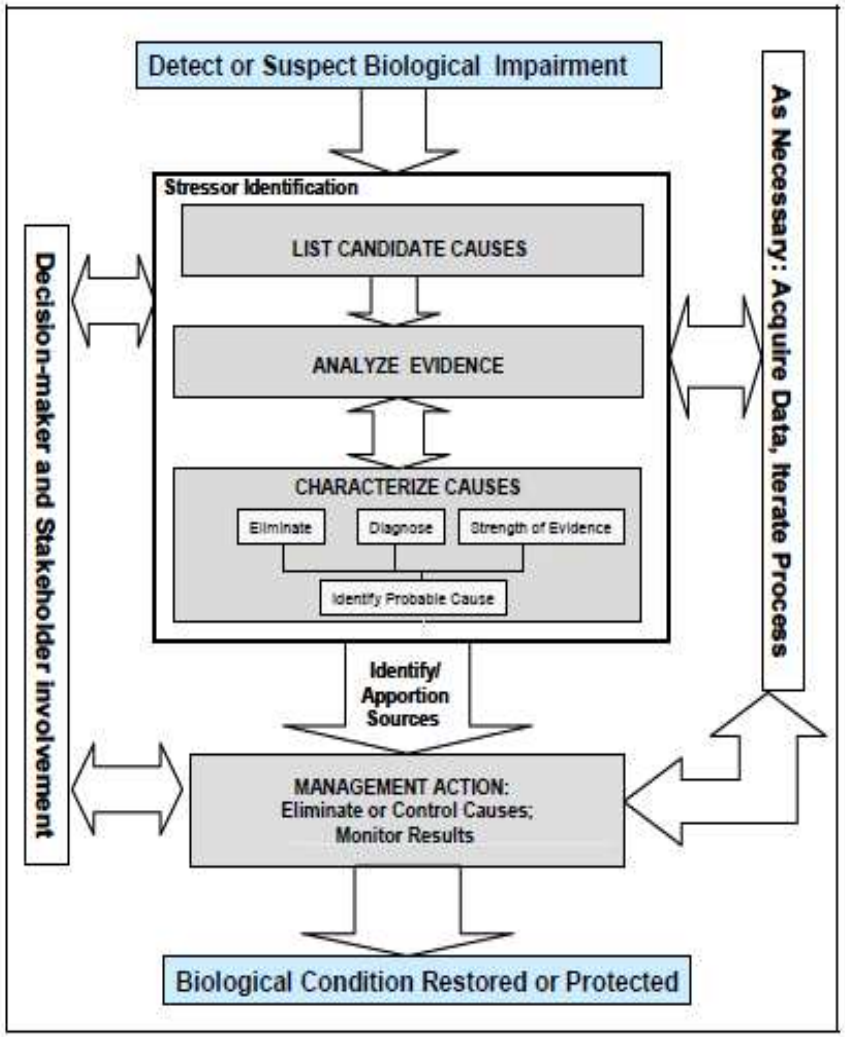
Water quality conceptual model





Safe Water and Food Security for all of us

Political will is there



Ganga getting polluted: Aug 20, 2016

Union minister of water resources, river development and Ganga rejuvenation- Ms **Uma Bharti**

Ganga is not polluted by flowers, 'Poojan Samagri' and the mortal remains instead the plastic waste, sewage discharge from untapped nullahs (drains) and effluents from the leather tanneries do pollute it.

- Adoption the principle of Zero Liquid Discharge (ZLD)
- Reuse treated water for gardening and for purposes. Reuse of wastewater by railways and refineries
- ZLD will be applied to the Sewage Treatment Plants (STPs) also“.

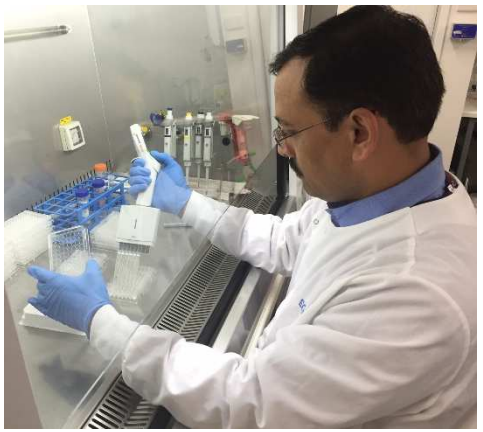
Impact and Outcomes

Scientific cooperation, technology transfer and capacity building.

Sharing of Australia's expertise in water quality monitoring to guide management decisions- learning from each other.

Improved decision making, which will help to support sustainable development and safe water for ecosystem and human health

Ensure effective abatement of pollution and rejuvenation of the river Ganga by adopting a river basin approach to promote inter-sectoral co-ordination for comprehensive planning and management mandate of National Ganga River Basin Authority (NGRBA)



Thank you

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