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# **Antibiotic Use and Waste Management in West Bengal Aquaculture**

A CSE study

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# Antibiotic resistance and antibiotic use in food animals

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- **Antibiotic resistance (ABR) is a global public health threat. Antibiotics are increasingly becoming ineffective**
  - ABR arises when bacteria survive exposure to an antibiotic that would normally kill them or stop their growth
  - ABR leads to greater spread of infectious diseases, difficulty in treating common infections, uncertainty in success of high-end procedures, longer hospital stays and expensive treatments
- **Besides humans, antibiotic use animals is linked with growing resistance**
  - Non-therapeutic use in food animals leads to greater emergence of antibiotic resistance and spread through food, direct contact and environment



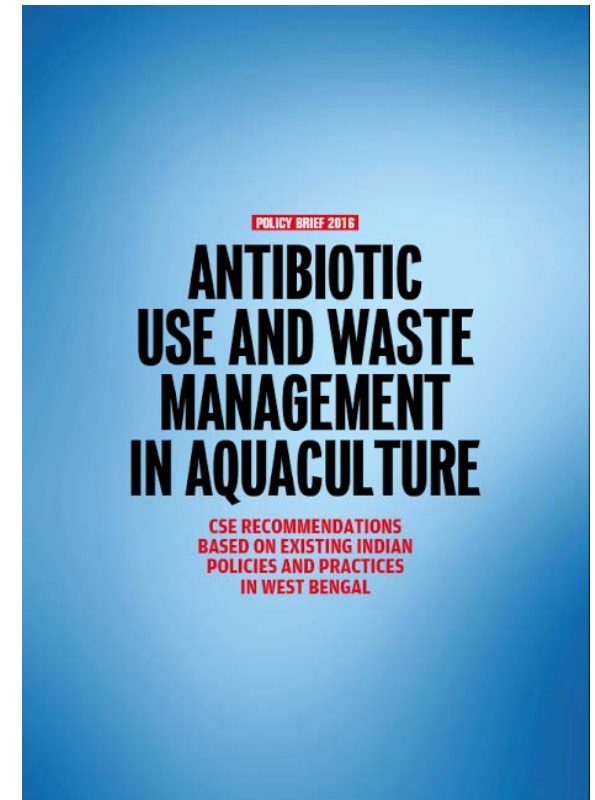
# CSE studies: Antibiotic use in food animals in India



2010



2014



Sept 2016





# Indian fisheries sector

- Includes fish that is **captured** from seas and rivers and those **cultured** in farms (aquaculture). India ranked **second in global aquaculture production**, with a share of about 6.6% in 2014
- Total fish production was 100.7 lakh tonnes in 2014–15. Over 65 % of this was from **inland fisheries** and the remaining from marine fisheries. Inland aquaculture mainly includes culture in freshwater and brackish water

## Key fish producing states

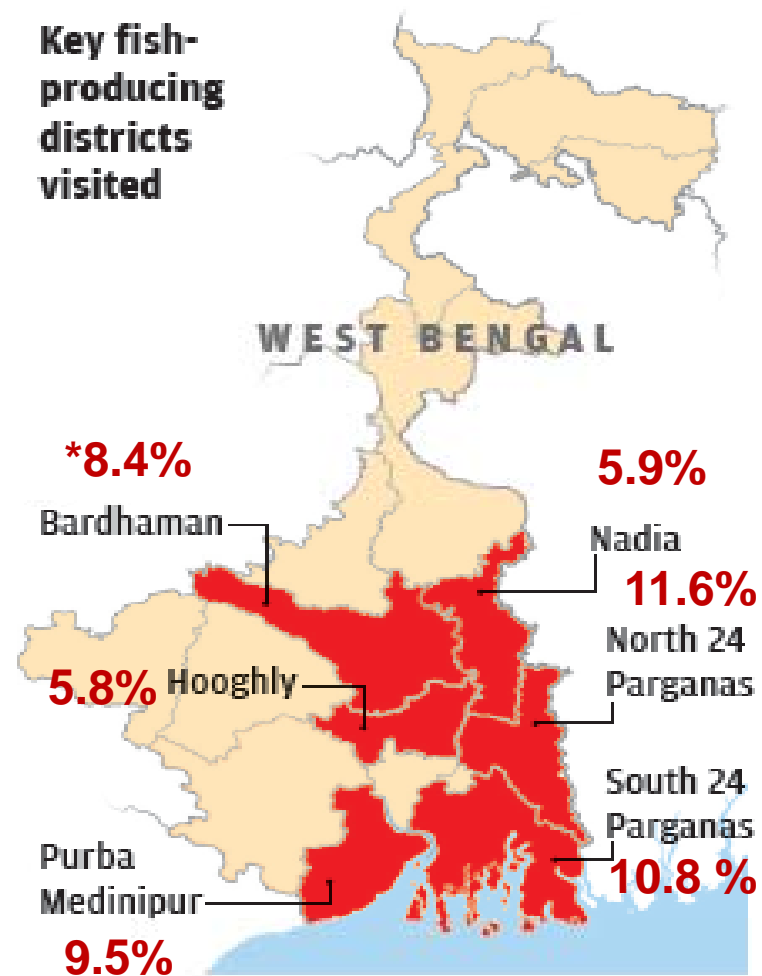
	Contribution to Indian fish production (%)
Andhra Pradesh	21.1
West Bengal	16.5
Gujarat	8.3
Kerala	7.4
Tamil Nadu	6.5

*Source: Handbook on Fisheries Statistics 2014, DADF; Note: Percentage contribution of states calculated based on total Indian fish production in 2013–14, 95.8 lakh tonnes*



## CSE visited aquaculture farms in West Bengal

- WB fish production: 16.7 lakh tonnes in 2014-15
- About 86% of which is inland fish production (~14.4 lakh tonnes) of which inland freshwater culture is a large part
- A total of **sixteen farms** and **six hatcheries** were visited in **six key districts** with high fish production
- These include traditional, **semi-intensive** and **intensive** freshwater and brackish water farms



*\*Contribution to total WB fish production*



## Antibiotics were used indiscriminately

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- Rampant antibiotic use in freshwater farms, brackish water farms as well as hatcheries
- In about 50% farms/hatcheries, routine antibiotic use was accepted or an evidence of antibiotic use was found on-site
- Purba Medinipur, which has mostly intensive farms, saw highest cases of people admitting to antibiotic use, while North 24 Parganas, which saw the lowest, has mostly traditional farms
- Antibiotics were largely given through feed and/or water. Such mass preventive measures resulting in antibiotic exposure to entire fish stocks, including uninfected fish





## Few examples:



**Cephalexin**



**Antibac containing 90% streptomycin**



**Augmentin**



**OTC sale of human grade antibiotics**



**Enrofloxacin, tetracycline, amoxicillin bottles picked from a freshwater farm**



## Antibiotics used include those which are critically important for humans

Antibiotic	Importance to human medicine*	Status as per CAA guidelines for brackish water
Oxytetracycline	Highly important	Permitted
Tetracycline	Highly important	
Enrofloxacin	Critically important	Prohibited
Ciprofloxacin	Critically important	
Norfloxacin	Critically important	
Ampicillin	Critically important	Not specified**
Dicloxacillin	Highly important	
Amoxicillin	Critically important	
Azithromycin	Critically important	
Cephalexin	Highly important	
Streptomycin	Critically important	
Kanamycin	Critically important	

\*As per the WHO list of Critically Important Antimicrobials for Human Medicine (2011). \*\* This leads to a gap, i.e. such antibiotics could potentially be used as long as their residue is not detected





# Unregulated availability of antibiotics

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- **Over-the-counter (OTC) sale of antibiotics**
  - Antibiotics were found to be sold by pharmacists without any prescription to farmers across districts
- **Use of antibiotics labelled for animals but not for fish**
  - Farmers used veterinary grade antibiotics labelled for use in poultry or livestock, but not specifically fish
  - Limited awareness about required dosage and withdrawal periods
  - Administered antibiotic was based on farmer experience and word of mouth
- **Use of antibiotics labelled for use in humans**
  - Antibiotic tablets and capsules meant for human use being sold to farmers
  - Most of these are critically important for humans



# **No professional disease management in fisheries (1/2)**

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- **Fisheries science professionals not adequately trained and authorized to prescribe medicines**
  - Limited focus on fish pharmacology in fisheries science curriculum
  - Fishery officers not authorized to prescribe medicines; no registered medical practitioners or doctors for fish
  - Little thrust on fish diseases in the veterinary curriculum
- **Farmers rely largely on peers, quacks, company representatives and self- discretion**
  - Guidance from a fishery officer not always available as per farmers
  - Officials cite reasons such as additional administrative responsibilities and limited staff



# No professional disease management in fisheries (2/2)

- **Inconsistency in recommending antibiotic use**
  - Training manuals recommend use of furazolidone and chloramphenicol for disease prevention. Both are prohibited.
  - Recommend antibiotic use for growth promotion

**Also, feed premix with antibiotics promoted online for improving growth and body**

Company	Brand	Antibiotic present
Neospark	Oxy-100-FS <sup>23</sup>	Oxytetracycline
Advanced Aqua Biotechnologies	DOX-ADD <sup>24</sup>	Doxycycline
	ADDCIP-M <sup>25</sup>	Ciprofloxacin
	FURZAZ-20 <sup>26</sup>	Furazolidone
	OXYTREAT-5 <sup>27</sup>	Tetracycline
Kaizen Biosciences	DOX-KZ <sup>28</sup>	Doxycycline
	OXYTREAT-10 <sup>29</sup>	Oxytetracycline
	FURA TREAT-20 <sup>30</sup>	Furazolidone
Vibrac India	Laybro Mix <sup>31</sup>	Colistin sulphate, Doxycycline



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# **Waste management practices in West Bengal aquaculture**



# Aquaculture waste and antibiotic resistance

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- Aquaculture waste is largely liquid. It also contains unconsumed fish feed, dead fish, plankton, fecal matter, eggshells and chemicals, including antibiotics.
  - All waste except chemicals can increase the organic load in water, which can act as a source of nutrition for bacteria, helping them to multiply
- Continuous interplay between antibiotics and bacteria in water and wastewater can increase resistance reservoirs in the aquatic environment
  - Wastewater treatment can reduce the organic load and limit growth of bacteria, including those which are resistant. It can also help prevent easy passage of antibiotic residues into the environment



# Discharge of untreated wastewater is common

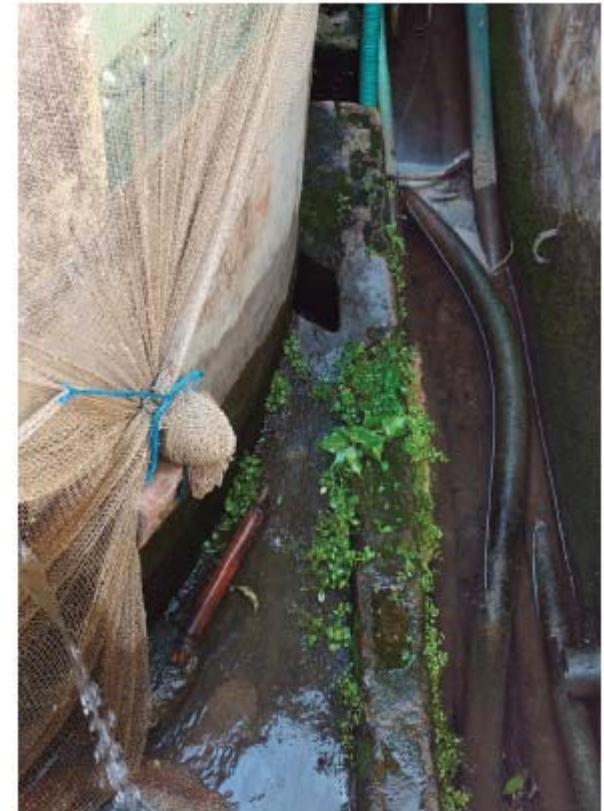
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- Across districts, farms and hatcheries, wastewater without treatment was found to be:
  - Discharged into canals from which the water was sourced
  - Reused in broodstock ponds
  - Released into agricultural fields
  - Let out in sewage drains
- Periodic water exchange was not found to be practiced
- *On the other hand, solid waste, including expired antibiotics and chemicals are disposed by burying in pits*





## Few examples:



**This hatchery in Hooghly reuses its wastewater without treating it, while the other in Bardhaman (right) releases wastewater directly into a drain**



## Effluent Treatment System (ETS) not set up anywhere

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- No ETS observed in any farm or hatchery across six districts (*CAA guidelines for shrimp aquaculture mandate ETS for all hatcheries and farms above 5 hectares*)
  - Big farmers are unwilling to invest in setting up an ETS, medium to small farmers are unaware or prefer utilizing the designated area for fish farming
- Minimal supervision by concerned officials from Department of Fisheries or Coastal Aquaculture Authority
  - Reasons cited include limited human resources and outreach constraints



# No monitoring by pollution control board

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- **Aquaculture is considered more of agriculture than industry and waste from it is therefore not a priority for CPCB or SPCB.**
  - Waste from aquaculture farms is not part of the MoEFCC categorization based pollution-causing potential
- **No specific standards by CPCB for waste from aquaculture farms.** General standards for discharge of effluents as per Environment (Protection) Rules 1986 available
- Effluent standards by CAA guidelines applicable for brackish-water farm
- There are no standards for antibiotic residues in fish-farm waste as of now



# Effluent discharge: CAA standards and General standards by CPCB

Parameter*		Standards for wastewater discharged from aquaculture farms, hatcheries, feed mills and processing units by CAA		General standards for discharge of effluents by CPCB			
		Coastal marine waters	Creeks estuaries when same inland water course is used as water source and disposal point	Inland surface water	Public sewers	Land for irrigation	Marine coastal areas
pH		6.0–8.5	6.0–8.5	5.5–9.0	5.5–9.0	5.5–9.0	5.5–9.0
Dissolved Oxygen (DO), mg/l		Not less than 3	Not less than 3	–	–	–	–
Suspended solids, mg/l		100	100	100	600	200	100 (for process waste-water)
Free ammonia (as NH <sub>3</sub> -N), mg/l		1	0.5	5.0	–	–	5.0
Biochemical Oxygen Demand (BOD), mg/l Max	3 days, 27°C	–	–	30	350	100	100
	5 days, 20°C	50	20	–	–	–	–
Chemical Oxygen Demand (COD), mg/l Max		100	75	250	–	–	250
Dissolved phosphate (as P), mg/l Max		0.4	0.2	5.0	–	–	–
Total nitrogen (as N) mg/l		2.0	2.0	–	–	–	–

Source: General Standards for Discharge of Environmental Pollutants [The Environment (Protection) Rules, 1986]; Guidelines for regulating Coastal Aquaculture; '–' means no standard available; \*Parameters are limited to those present in CAA guidelines



# Noncompliance of CAA guidelines

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- **CAA guidelines discourage the conversion of agricultural land for aquaculture**
  - Most brackish-water farms were said to have been converted from agricultural lands taken on lease; also observed in the case of freshwater farms
- **Shrimp farm registration is mandatory with ETS as a prerequisite**
  - Small farmers not motivated by benefits of registration
  - Big farmers often try to sidestep requirements
- **CAA recommends only traditional/improved traditional and scientific extensive systems**
  - Intensive shrimp farming is widely practiced on the ground



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# **Key Policy Gaps and Recommendations**





# Key policy gaps

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- Freshwater culture remains **largely unregulated**
  - Existing guidelines only for few species and are less specific w.r.t. antibiotic use and waste management
- Existing Indian policies and guidelines on fisheries are **focused on export-oriented coastal aquaculture**, which is primarily brackishwater culture
  - Guidelines for coastal aquaculture
    - List of banned antibiotics is limited and based on exports
    - Many antibiotics can still be used as long as **residues are not detected**
    - Does not recognize **non-therapeutic use**
- The Indian standards, for fish feed by BIS and antibiotic residues in fish meat by FSSAI, **draw largely from export-oriented list of antibiotics** in coastal aquaculture guidelines



# Antibiotics allowed/prohibited by CAA; also referred by BIS and FSSAI

Antibiotics allowed by the CAA with MRLs	<ul style="list-style-type: none"><li>• Tetracycline, oxytetracycline</li><li>• Oxolinic acid</li><li>• Trimethoprim</li></ul>
Antibiotics banned for use in shrimp culture by CAA	<ul style="list-style-type: none"><li>• Nitrofurans including furaltadone, furazolidone, furylfuramide, nifuratel, nifuroxime, nifurprazine, nitrofurantoin and nitrofurazone</li><li>• Neomycin</li><li>• Chloramphenicol</li><li>• Nalidixic acid</li><li>• Sulphamethoxazole</li><li>• Dapsone</li><li>• Sulfanoamide drugs (except approved sulfadimethoxine, sulfabromomethazine and sulfaethoxypyridazine)</li><li>• Fluoroquinolones</li><li>• Glycopeptides</li></ul>



## Key policy gaps

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- **BIS specifications for fish feed** (carp, catfish, marine shrimp, freshwater prawn)
  - Voluntary guidelines
  - Allows use of many other antibiotics as long as labelled
  - Does not regulate feed premix
- **Food Safety and Standards** (Contaminants, Toxins and Residues) Regulations, 2011
  - No list of prohibited antibiotics in fish/fish products
  - No provision for monitoring antibiotic residues other than four with tolerance limits and leaves them unregulated
- **Rule 97 of Drugs and Cosmetics Rules 1945**
  - Does not mention if this is applicable/not applicable to fish
- No specific standards available for waste from aquaculture farms



# CSE Recommendations (1/4)

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- **One comprehensive framework including the law and institutions should address sustainable brackish water and freshwater aquaculture**
  - The existing framework for coastal aquaculture should be strengthened and expanded to cover freshwater culture
  - The CAA could be converted into an Aquaculture Authority, which should work with state fisheries departments and other central agencies for implementation
- **In the interim, the Coastal Aquaculture Authority should ensure adequate implementation of its guidelines/rules**
  - Strengthen guidelines and prohibit non-therapeutic antibiotic use
  - Guidelines to include an updated list of prohibited antibiotics and a separate list of allowed antibiotics based on current medical importance to humans and resistance trends



## CSE Recommendations (2/4)

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- **The CPCB should recognize aquaculture waste as a public-health hazard**
  - Formulate necessary policies to control ABR spread from farm waste
  - Standards for no antibiotic residues and minimal bacterial load in discharged effluents to be developed
  - Adequate monitoring of aquaculture waste by SPCBs
- **The DADF should play a central role in limiting antibiotic use and spread of ABR from aquaculture through action and awareness**
  - Formalize professional disease management in fisheries through curriculum and practice
  - Ensure authorization of fishery science professionals to prescribe medicines
  - Develop a surveillance system for antibiotic use in fish and resistance in fish and fish environment. This information should be available in the public domain



## CSE Recommendations (3/4)

- **The CDSCO should make a list of antibiotics approved for aquaculture that factors-in medically important antibiotics for humans and current resistance trends**
  - Develop an online national-level database to track distribution and sale of antibiotics
  - Update Rule 97 of Drugs and Cosmetics Act to specify symbolic representation of fish
  - State drug departments to ensure that approved antibiotics, suitably labelled for use in fish, are sold against a prescription.
  - Modify Drugs and Cosmetics legislation to recognize non-therapeutic use and regulate manufacturing, sale and import of feed and feed premix containing antibiotics





## CSE Recommendations (4/4)

**CAA should  
make antibi  
free inputs  
mandatory  
Registration  
mandatory?**

- **BIS should amend fish-feed standards**
  - Prohibit antibiotic use in feed and make them mandatory
  - Make a new mandatory standard for medicated feed
  - Regulate feed premixes to control on-site addition of antibiotics
- **FSSAI should develop a framework for surveillance of antibiotic residues and resistant bacteria in fish and fish products**
  - Standards should support detection of all antibiotic use, including those unapproved
  - Discourage the use of critically important antibiotics through stringent standards set at the limit of detection
  - Periodic monitoring of residues by State food authorities; results should be available in the public domain



# Thank you!

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