APCTT
Asian and Pacific Centre
for Transfer of Technology
ESCAP

RUSSIAN HOUSE
OF INTERNATIONAL
SCIENTIFIC AND TECHNICAL
COOPERATION

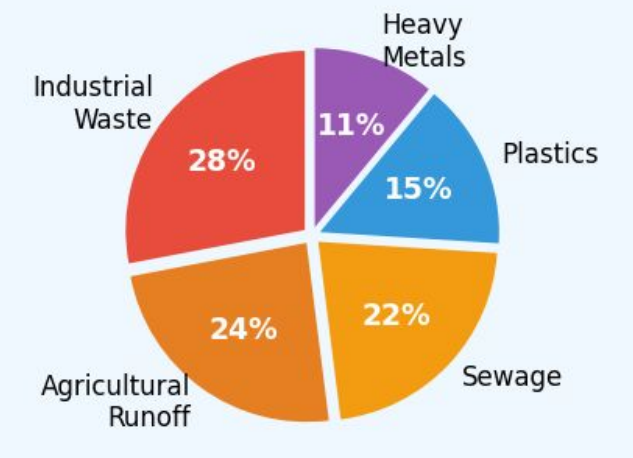
Application of Biosensors and Artificial Intelligence for Biomonitoring Aquatic Ecosystems Towards Achieving Sustainable Water Utilization

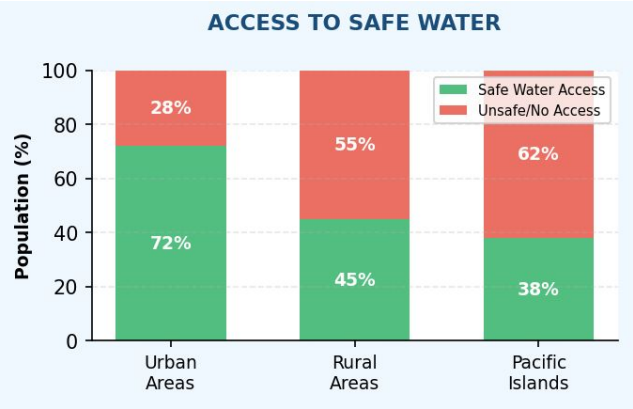
Innovative technologies in the field of water conservation

DRINKING WATER POLLUTION PROBLEM

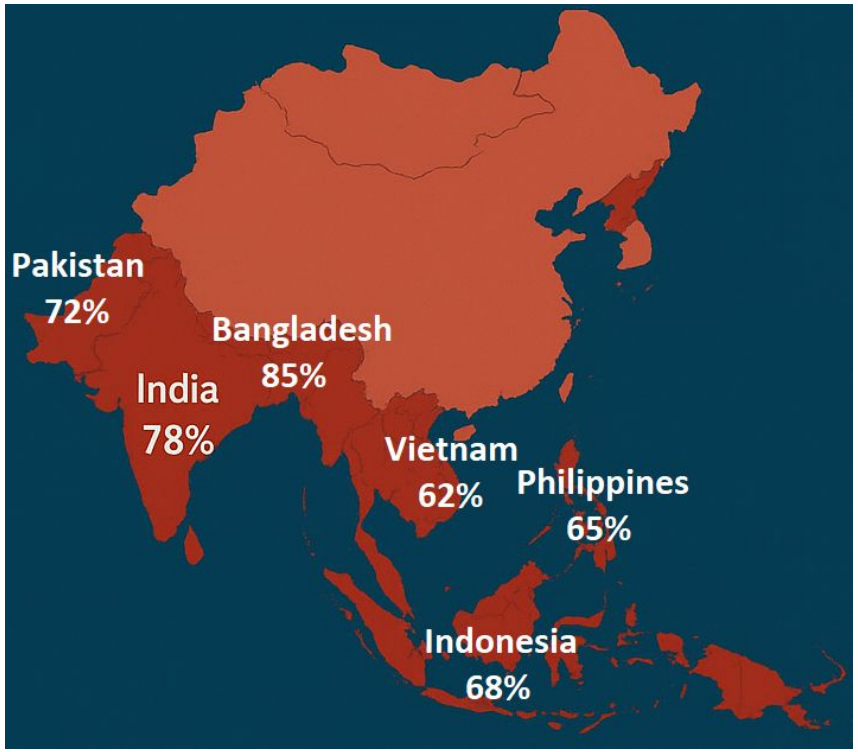
Asia-Pacific Region

CONTAMINATION TYPES





MOST AFFECTED REGIONS



5 Million
People lack basic drinking water services in Pacific

75%
Regional GDP depends on water-related sectors

60%
Groundwater sources contaminated

MAJOR POLLUTION SOURCES

$31B annually in total losses

Sources: WHO, UNICEF, World Economic Forum, and the Asian Development Bank

EXISTING SOLUTIONS

Physicochemical laboratory methods

DISADVANTAGES

01 expensive

02 not automated

03 not promptly (sampling once every 10 days)

04 does not reflect the full picture of pollution by limiting the indicators

Bioindication (water utility of St. Petersburg)

DISADVANTAGES

01 expensive

02 limited use in laboratory only

03 crayfish should be changed every 10 days

OUR SOLUTION

ECOBIOMONITOR aquatic environment monitoring system using AI and mussel-based biosensors

ADVANTAGES

01 integrated assessment – reflection of the full picture of pollution

02 efficiency – detection of contamination in real time

03 replacement of biosensors no more than once a year

04 applicability in any aquatic environment

05 automation

CONSUMERS AND EFFECTS

CITY ADMINISTRATION

70% reduce lab costs by replacing manual sampling with automated biosensors

35% data-driven scheduling is estimated to lower long-term maintenance costs

20% quicker detection and remediation help reduce public health risks, potentially lowering healthcare costs

OIL AND GAS PRODUCING COMPANIES

10 min negative event response time

MUSSEL AND OYSTER FARMS

20% Reducing man-hours and maintenance costs for aquaculture plantations

BEACH OPERATORS, SANATORIUMS, HOTELS, RECREATION CENTERS

50% reduction of the timeframe for introducing measures to prevent the spread of infectious diseases among the population

РОССИЙСКАЯ ФЕДЕРАЦИЯ

ПАТЕНТ

НА ИЗОБРЕТЕНИЕ

№ 2779728

АВТОМАТИЗИРОВАННЫЙ БИОСЕНСОРНЫЙ КОМПЛЕКС РАННЕГО ОПОВЕЩЕНИЯ ДЛЯ ЭКОЛОГИЧЕСКОГО МОНИТОРИНГА ВОДНОЙ СРЕДЫ

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Дата государственной регистрации в Государственном реестре изобретений Российской Федерации 12 сентября 2022 г.
Срок действия исключительного права на изобретение истекает 16 августа 2041 г.

Руководитель Федеральной службы по интеллектуальной собственности

Ю.С. Зубов

РОССИЙСКАЯ ФЕДЕРАЦИЯ

ПАТЕНТ

НА ИЗОБРЕТЕНИЕ

№ 2755407

СПОСОБ КОНТРОЛЯ КАЧЕСТВА ВОДЫ И ДВУХКАНАЛЬНАЯ БИОСЕНСОРНАЯ УСТАНОВКА ДЛЯ ЕГО ОСУЩЕСТВЛЕНИЯ

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Дата государственной регистрации в Государственном реестре изобретений Российской Федерации 15 сентября 2021 г.
Срок действия исключительного права на изобретение истекает 15 декабря 2040 г.

Руководитель Федеральной службы по интеллектуальной собственности

Г.П. Ивлиев

Intellectual property:
2 patents and 4 software registration certificates

CURRENT STAGE OF THE PROJECT AND RESOURCE PROVISION

TWO PILOTS WERE CONDUCTED

- Mussel farm LLC NIO Marikultura (Sevastopol) 4 months 2022
- Mussel farm LLC CMPR (Sevastopol) 2 months 2021

INVESTMENTS MADE

- Research grant from the Russian Foundation for Basic Research, 1.2 million rubles.
- Research grant from the Russian Science Foundation 3.0 million rubles.
- R&D of JSC Concern Okeanpribor 2.2 million rubles.

SALES

- production of one system set Scientific and Educational Center "MoreAgroBioTech" 2 million rubles.

ECOBIOMONITOR TECHNOLOGY

Features of the technology

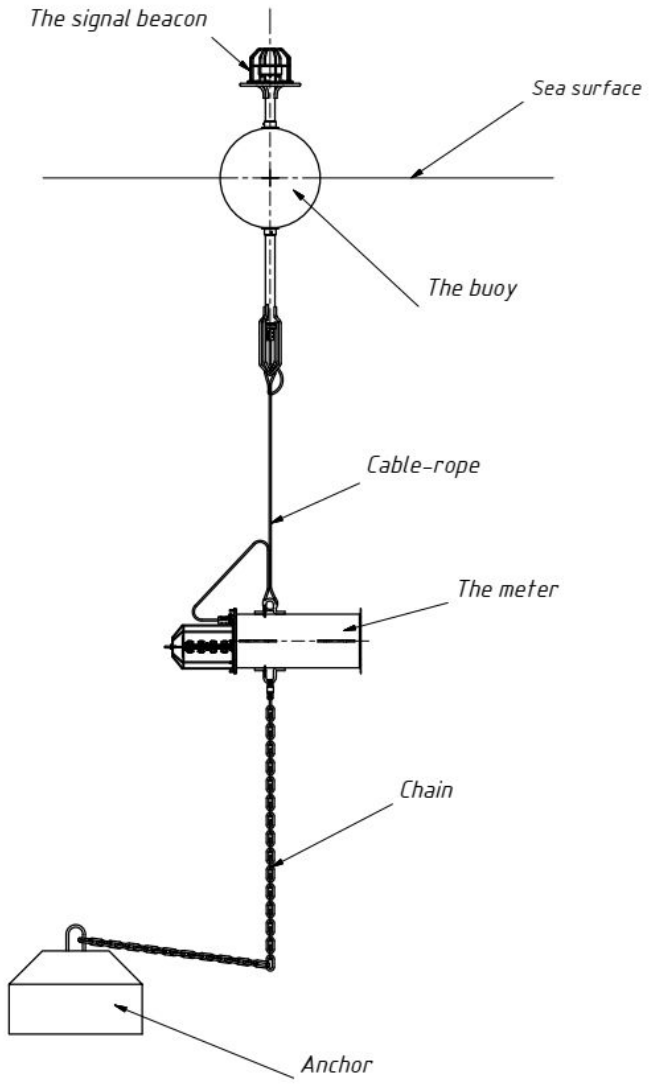
01 Mussels as biosensors function in the system for up to three years

02 AI generates alarm signal

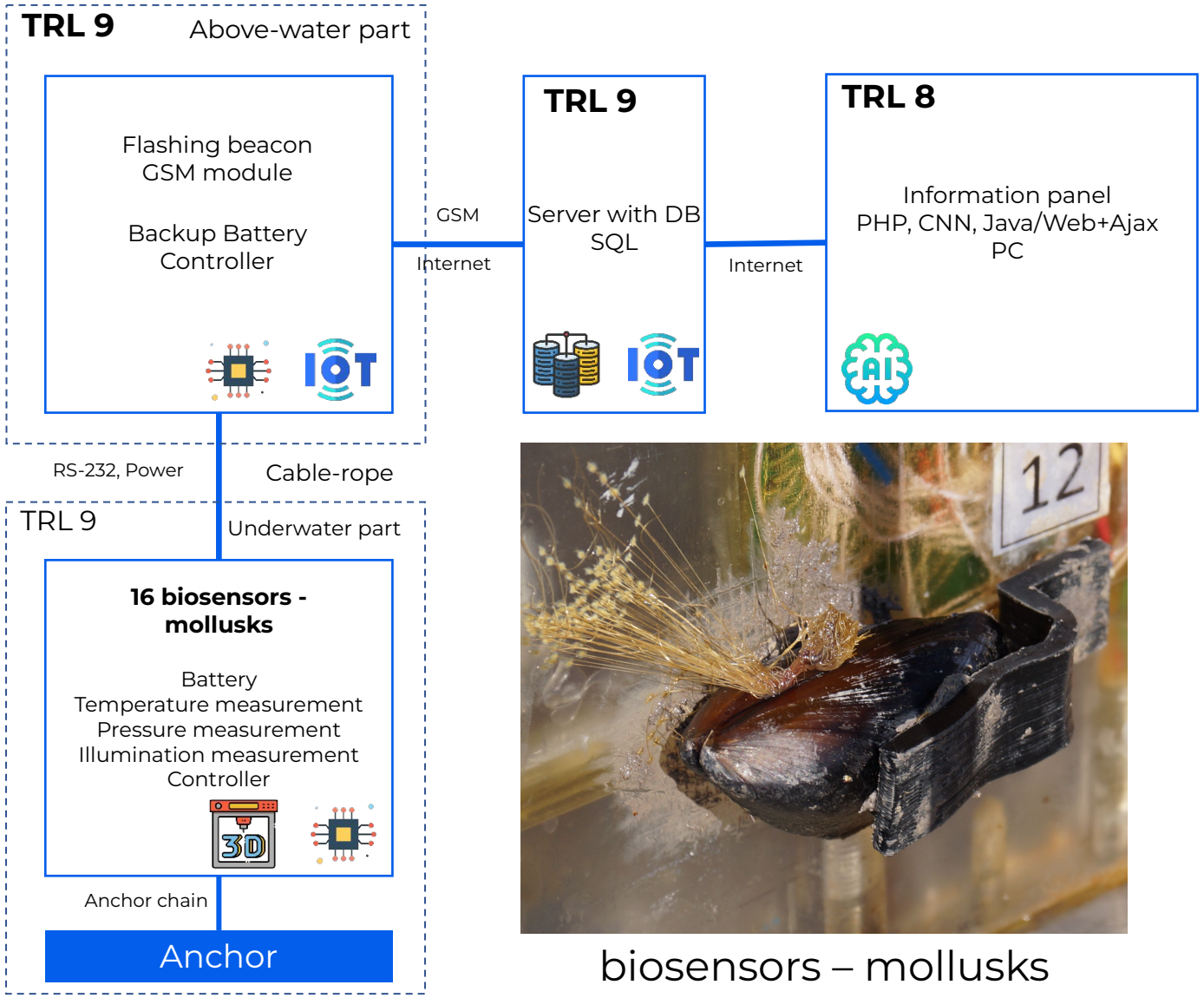
03 Instant response to pollution

04 IoT for information transfer and system management

05 Native species of mollusks for different water bodies



ECOBIOMONITOR TECHNOLOGY



biosensors – mollusks
with magnets and hall sensors

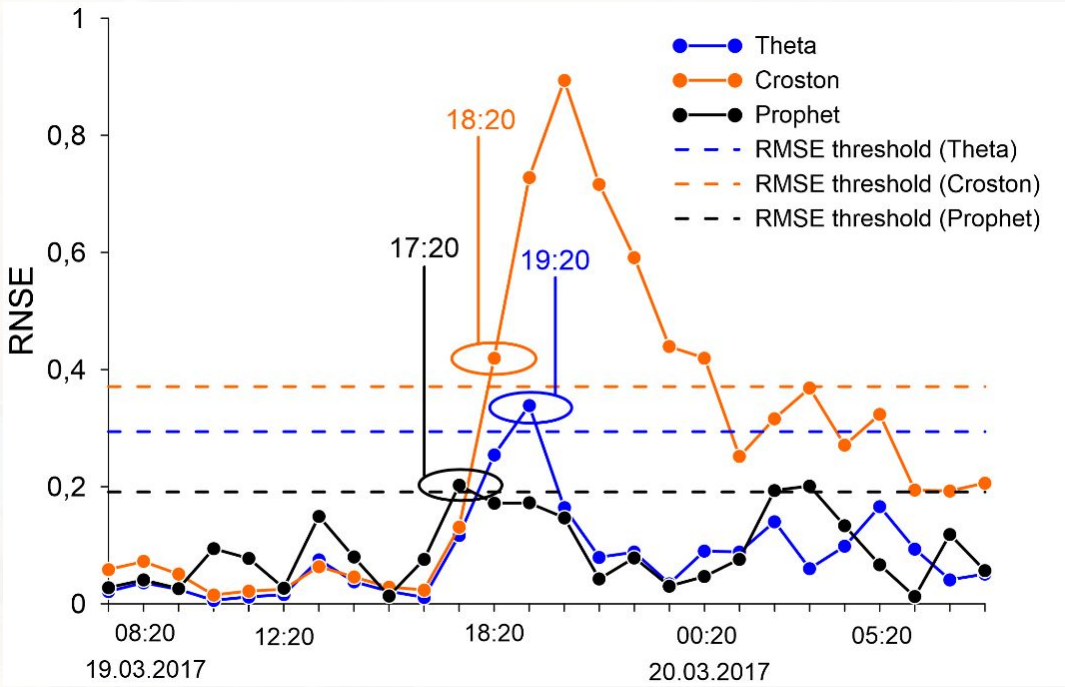
COMPETITOR ANALYSIS

	Ecobiomonitor	Manual sampling	BioArgus	Buoys with physical and chemical sensors	Musselmonitor®
				Russia	World
Automation	✓	✗	✓	✓	✓
Service interval, days	> 180	✗	10	<20	> 180
Integral characteristic	✓	✗	✓	✗	✓
Response time, minutes	< 1	A few days	< 1	< 1	< 1
Work directly in water	✓	✓	✗	✓	✓
Work in any type of water	✓	✓	✗	✓	✓
Finished Solution	✓	✓	✓	✗	✗

Main advantage: mussels as biosensors quickly detect most contaminants

Machine learning for anomaly detection

Averaging time, number of prediction points	Method		
	Theta	Croston	Prophet
Anomaly 1 (March 19, 2017.)			
5 min, 6 points	18:35	18:35	18:35
10 min, 1 point		18:40	
10 min, 2 points	18:30	18:30	
10 min, 3 points	18:40	18:40	18:40
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	19:20	18:20	17:20
30 min, 3 points	18:30	19:30	18:30
Anomaly 2 (April 14, 2017)			
5 min, 6 points	12:05	12:05	12:05
10 min, 1 point		12:30	
10 min, 2 points	12:30	12:30	
10 min, 3 points	12:40	12:40	12:40
10 min, 6 points	**12:10**	**12:10**	**12:10**
20 min, 3 points	12:20	12:20	12:20
30 min, 3 points	12:30	12:30	12:30
Anomaly 3 (April 24, 2017)			
5 min, 6 points	17:35	17:35	17:35
10 min, 1 point		17:50	
10 min, 2 points	17:50	17:50	
10 min, 3 points	17:40	17:40	17:40
10 min, 6 points	**17:10**	**17:10**	**17:10**
20 min, 3 points	17:20	17:20	17:20
30 min, 2 points	17:30	17:30	17:30



TEAM AND CONTACTS

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MANAGEMENT

- PhD
- 119 publications
  16 patents
- 7 years of project management

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Ryazanov Victor

DEVELOPMENT OF THE MECHANICAL PART

- 30 years of development, design and manufacture of marine instruments

AUTHOR OF THE IDEA

Trusevich Valery

DEVELOPMENT OF BIOTECHNOLOGY

- PhD
- 25 years of research and development of biosensor systems
- 49 publications, 2 patents

Kuzmin Konstantin

IT DEVELOPMENT

- 15 years of experience in developing algorithmic software for marine instruments