

## Study Committee C3 Power System Environmental Performance

10164\_2022

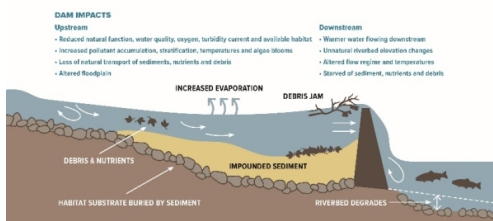
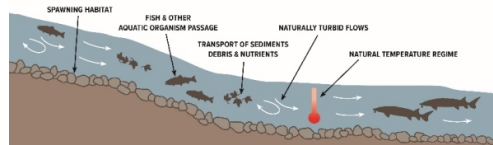
### PEIXE VIVO PROGRAM: LONG-TERM ACTIONS FOR FISH CONSERVATION IN DAMMED BRAZILIAN RIVERS

Raquel Coelho LOURES FONTES, Miriam Aparecida de CASTRO, Rafael Augusto FIORINE

Cemig Geração e Transmissão SA

#### MOTIVATION

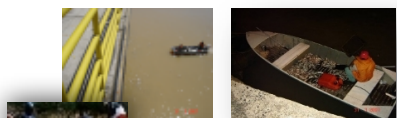
The loss of biodiversity in recent decades and the need to understand the main factors and mechanisms that drive this loss, reinforce the importance of effective environmental programs by companies in the electricity sector. Dams built for electricity generation transform rivers by changing water, sediments and nutrients flow, water temperatures, affecting the ecological integrity of aquatic systems, being considered the major cause of changes and loss of fish diversity over time.



*Ecosystem impacts due to dam construction. Features before and after impoundment. (Image source: The Boardman River Dam Project)*

#### Fish mortality events with tons of dead fish

- There have been a series of environmental accidents involving fish death at the Cemig's hydropower plants, during the first decade of 2000s. Those accidents summed over 52 tons of dead fish during operational and maintenance procedures in the hydropower plants.
- Fish mortality in Três Marias Dam in 2007



#### Major consequences

- Ecological Impacts
- Conflicts with local communities
- Loss of confidence with environmental agencies
- Fines (growing values each time)
- Image problems to stakeholders

#### PEIXE VIVO PROGRAM



#### Mission

*Minimize the impact on fish, searching solutions and management technologies that integrate the electricity generation by Cemig to the conservation of native fish species, promoting community involvement.*



#### Principles

1. Adopt scientific criteria for decision making.
2. Modify practices according to information generated.
3. Encourage the dissemination of program information to society
4. Work in partnership with other institutions

#### Pillars



#### Main themes

In general, the Peixe Vivo Program works on a wide range of topics related to fish fauna and its relation to hydropower generation. Below we highlight some of these:



- Risk assessment of fish death in operation and maintenance of generating units.
- Support with engineering to establish operating rules to minimize the impact on fish.
- Establishment of guidelines for fish conservation and management programs within the scope of the Cemig Group.
- Management of strategic research projects and R&Ds.
- Monitoring and analysis of compliance with environmental conditions related to fish.
- Management of fish stocking program (fishing) and fish hatchery.
- Technical support for questions about fish passage systems

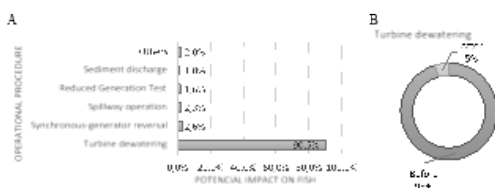
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A) The five operational procedure with the greatest potential to cause fish death in hydropower plants, in Cemig Group. B) Comparison of dead fish biomass during turbine dewatering between before the Program creation (2001 to 2007) and after Peixe Vivo (2008 to 2021).

Since the Peixe Vivo Program creation, fish deaths have been reduced in 77.7% at Cemig's hydropower plants, thereafter Cemig reduced 99.7% of its financial losses with fines.

#### Recommendations

Recommendations based on the studies developed to assess the risk of fish death:

- Deal with fish impact with transparency, recognizing the problem internally in the company and to stakeholders.
- Diagnose the impact and risks from operational procedures for fish in each hydropower plant, considering their particularities.
- Create an indicator that can measure this impact and perform compliance analysis periodically to assess the effectiveness of the control measures.
- Perform fish monitoring in hydropower plants tailrace periodically and prior to risky procedures.
- Biological data from monitoring can be investigated for their relationship with environmental and operational variables.
- Consider relevant environmental aspects during planning and execution of operational procedures (e.g. concentration of fish in the tailrace, duration of risky procedures, measures to rescue fish in entrapment points, quality of water, etc.).
- Environmental monitoring during risky operational procedures by biologists, fish specialists.
- Modify practices, when and if necessary, supported by the results of the periodic analysis of the indicator and the monitoring performed.

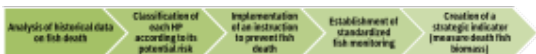
### PROTECTION OF FISH DURING MAINTENANCE AND OPERATION OF GENERATOR UNITS

Aims:

- identify and understand risky operational procedures for fish;
- propose measures and solutions to **reduce fish death**;
- assess the effectiveness of the measures and solutions proposed.



In 2008, the Risk Assessment of Fish Death (RAFID) methodology was created for fish protection during operation and maintenance of hydropower plants, following five steps:



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#### MONITORING, MANAGEMENT AND CONSERVATION ACTIONS FOR FISH

The program has 23 scientific projects in its portfolio, developed over the years, six of which are currently under development.

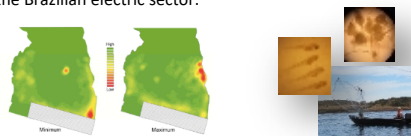


Technical-scientific production, from Jun/2007 to Jun/2022, that reflects the performance of the Peixe Vivo Program technical achievements developed by its staff and by collaborators in partnerships.

#### More efficient practices

Those academic results together with community inputs have been used to create practices that are more efficient involving the coexistence of hydropower plants and fish in Brazilian rivers. These results brought image gain for the company and greater credibility with the environmental agencies. Among the results we can highlight:

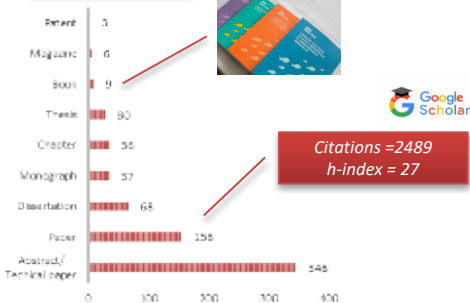
- Projects that assess the abundance and behavior of fish near hydropower plants verified and **recommended safer operational procedures to prevent fish deaths.**
- It was evidenced by one of the projects the importance of genetic tools in the **management of fish hatcheries** and that, monitoring after the release of juveniles is crucial for assessing the effectiveness of this measure. These issues have led to changes in technical specifications for contracting services and even **discussion with the environmental agencies regarding fish stocking efficiency.**
- Projects that assess ecological conditions in hydrographic basins where the company has projects, added new knowledge and **improved methods for: studies of eggs and larvae, monitoring of fish fauna and water quality, among others.**
- Projects developed to evaluate fish migration and identify spawning and recruitment sites, have been elucidating patterns of displacement of migratory species that, in addition to supporting **determinations on the need to install or not fish passages in some hydropower plants**, helped to understand the spatial and temporal distribution of fish in rivers.
- A project that evaluate the effectiveness of fish monitoring programs in hydropower plants' reservoirs established **10 guidelines that aim to improve management of monitoring programs** by companies of the Brazilian electric sector.



#### SOME CHALLENGES AND FUTURE PERSPECTIVES

- Problem recognition, transparency and interaction with environmental agencies
- Barrier of knowledge about fish diversity, importance of long-term monitoring
- Interaction between environmental and engineering areas
- Prevent fish death

Publications  
> 690



Collaborators  
N= 324

