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SWM SUSTAINABLE WILDLIFE MANAGEMENT PROGRAMME

Facts and figures from fish stock assessments in North Rupununi 2020-2021

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Contents

What is the NRDDB Fisheries Management Plan about?

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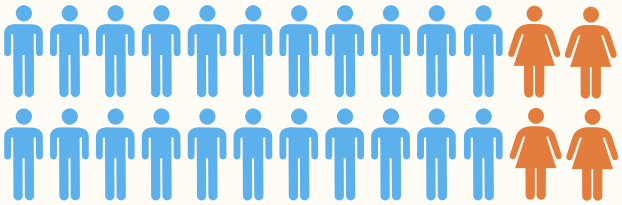
The North Rupununi District Development Board (NRDDB) started piloting an inland Fisheries Management Plan in Guyana in 2018. This new programme is a collaboration with local communities and the Ministry of Agriculture, Department of Fisheries. It receives support from the Sustainable Wildlife Management (SWM) Programme. The plan covers 386 km of the Essequibo, Rupununi and Rewa rivers. Implementation started in 2019 with raising awareness of fisheries guidelines through village meetings and river patrols. A comprehensive monitoring system was then put in place to assess fishing activities and the importance of fish for the communities that depend on this resource.

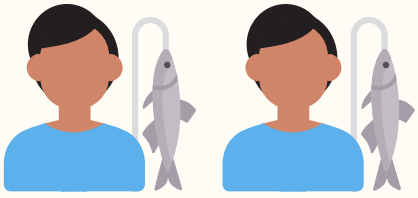
The field survey aims at monitoring changes in the number and size of arapaima *(Arapaima arapaima)* and other common fish species. This general survey is designed to support quantitative state assessments for target fish populations in lakes and rivers. Outcomes from the survey programmes and associated stock assessments are summarized here.

How were local communities involved?

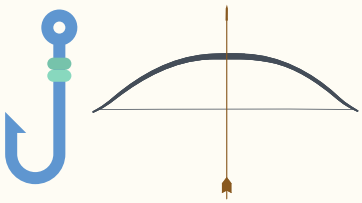
Local monitors from at least **six communities** contributed to each of the general fish surveys.



The surveys were advertised on the radio, asking village leaders to nominate **two fishers** to work with the team in their local fishing areas.



A total of **26 people** (4 female and 22 male) were trained in survey methods and participated in the surveys.



These activities involved intense field work which required **dedication and excellent knowledge of fish and fishing methods**.

Team members with traditional fisheries knowledge were an asset and contributed strongly to selection of survey methods and fishing locations.

How do the fish surveys work?

The arapaima surveys follow an approach developed in Brazil, which relies on the fact that this fish must surface periodically to breathe air. Trained observers can recognize individual surfacing fish, and estimate their size. A count is made of the total number of fish observed across a set of survey ponds. This count can be compared between surveys to evaluate how the arapaima population may be changing.

The general fish surveys took place during the rainy season, as larger fish migrate to breeding areas (in May), and at the end of rainy season when the water is receding and when juvenile fish are abundant (in October). The number of survey sites and the main survey gears changed from 2020 to 2021. As part of the local learning process, sampling in October 2020 used gill nets, cadel lines, cast nets and handlines. Sampling in May and November 2021 used cadel lines, carapix, seine and handlines. The shift to traditional local gears enabled more and larger fish to be caught. The result was a survey catch that was closer to the typical subsistence and commercial catch.

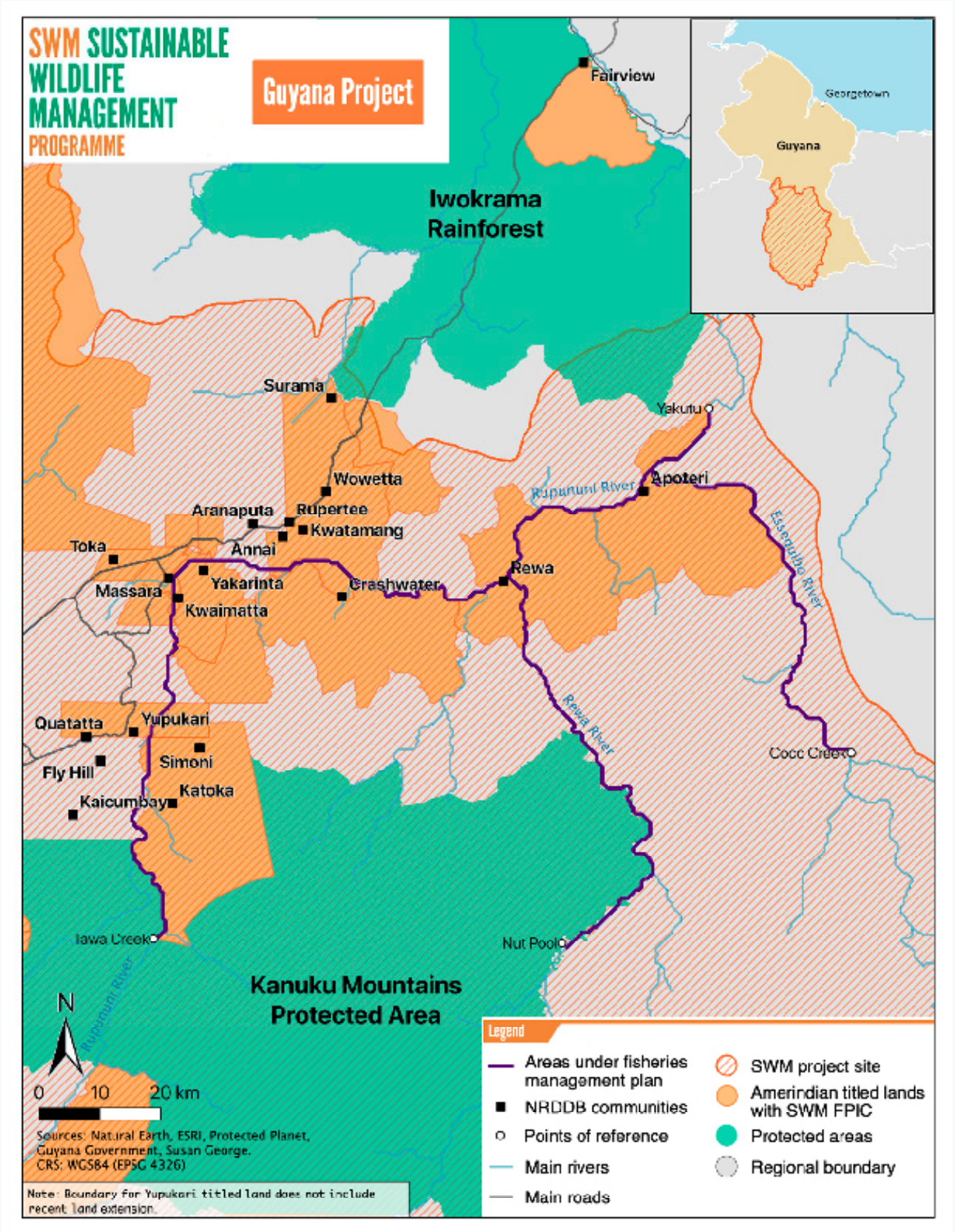
Fish were collected daily during two-hour intervals (6–8 a.m, 5–7 p.m and 9–11 p.m) at different sites. Fish were identified to species (where possible) and counted. The total length (cm) and weight (g) of each fish was measured. Water temperature and pH were recorded. NRDDB fisheries staff refined the methodology and conducted this activity with the assistance of local fishers. Arapaima surveys included 152 sampling sites. The general fish surveys were done in 46 sites.

How does the stock assessment work?

Fisheries management should be guided by knowledge of how target fish populations change over time. Stock assessments evaluate the state of important fish populations and whether these are sustainably managed. The arapaima survey provides a simple count assessment that can reveal population trends. Management intervention could be required if observed numbers decline.

This kind of count is not possible for the many other fish species caught in North Rupununi. It is also difficult to record landings of fish across such a large and diverse area. Instead, length-based assessment methods can be applied to the size distribution of the catch. These approaches assume that fishers select larger individuals and species, and exploited assemblages tend to have fewer big fish. The abundance of large fish observed in the survey can support empirical and model-based assessments that express the health of the stocks. An assessment model called Length Based-Spawning Potential Ratio (LB-SPR) has previously been applied to various tropical fish stocks and was tested for the North Rupununi survey data.

Which rivers are we surveying?



Map of Rupununi rivers under the Fisheries Management Plan and NRDDB communities

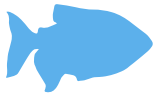
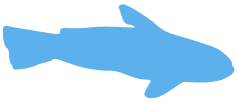
The boundaries and names shown and the designations used on these map(s) do not imply the expression of any opinion whatsoever on the part of FAO concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers and boundaries. Dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

What did we find?

Fishing was more productive in the Upper Rewa and Essequibo rivers than in the Upper Rupununi. The catch in October 2020 represented 3 099 individual fish from 105 species. Fish length ranged from 1.5 to 235.0 cm and weight from 4.0 to 8 165.0 g. Gill nets caught more small fish, while cadel lines and handlines were selected for larger individuals and species. Catches for the five most frequently observed species in October 2020 were as follows.

	Species	Common name	Total count
	*Pygocentrus nattereri*	Cashew piranha	354
	*Hydrolycus armatus*	Black-tailed baiara	281
	*Ageneiosus inermis*	Dawalu	216
	*Hydrolycus tatauaia*	Characin	82
	*Cichla ocellaris*	Peacock bass	55

The May (rainy season) survey used more local fishing gears and additional sites were added, with about 50 fish species being caught. Sites in and below the Rewa River and in Steamer Pond had lower Catch Per Unit of Effort (CPUE) than observed in the October 2020 survey, but fish species composition was similar. The most productive gear was seine, followed by cadel line and handline. Summary catches for the most frequently observed species in May were as follows.

	Species	Common name	Total count
	*Ageneiosus ucayalensis*	Duck catfish	195
	*Piaractus brachypomus*	Red pacu	59
	*Ageneiosus inermis*	Dawalu	54
	*Hydrolycus armatus*	Black-tailed baiara	53
	*Trachycorystes trachycorystes*	Black amiri	47

The most recent survey (November 2021) used the same sites and local gears as in May 2021. There were some differences in species composition, which may reflect the different season. Summary catches for the most frequently observed species were as follows.

	Species	Common name	Total count
	*Ageneiosus inermis*	Dawalu	220
	*Pygocentrus nattereri*	Cashew piranha	186
	*Cichla ocellaris*	Peacock bass	169
	*Curimata cyprinoides*	Sauw sauw	148
	*Hydrolycus armatus*	Black-tailed baiara	123

There was also a difference in catch size distribution, which is likely to reflect both environmental effects, e.g. the flood cycle and fish life history, and the different survey gears used. The greater abundance of larger individuals and species in the traditional gears makes this approach more suitable for length-based stock assessments.

What can we conclude?

It is not yet possible to comment on the state of fish stocks at different locations in North Rupununi. This process will require more data and additional analysis. The short period of the survey programme (2020–2021) and changes in the survey method mean that trends in fish stocks are not yet evident.

Therefore, current conclusions are limited to the state of selected important stocks across the whole survey area including *Ageneiosus ucayalensis, Piaractus brachypomus, Ageneiosus inermis and Hydrolycus armatus*.

Assessments based on empirical and model-based indicators were developed for each of the selected fish species. These species represent a range of life history types and maximum sizes, and hence they have the potential to express the state of the broader fish community.

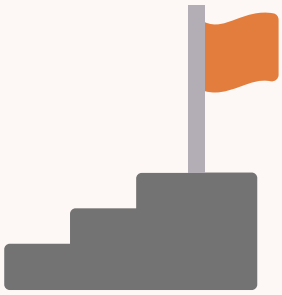
Population status of selected species is shown below:

Note: The assessment model did not fit for two species (*Piaractus brachypomus* and *Ageneiousus inermis*) with smaller sample sizes.

	Year	Species	Total count	State
	May 2021	*Ageneiosus ucayalensis*	195	Good
	May 2021	*Piaractus brachypomus*	59	See "Note" section above
	May 2021	*Ageneiosus inermis*	54	See "Note" section above
	May 2021	*Hydrolycus armatus*	53	Good
	Nov 2021	*Pygocentrus nattereri*	186	Good
	Nov 2021	*Boulengerella Cuvieri*	88	Good
	Nov 2021	*Ageneiosus inermis*	220	Moderate
	Nov 2021	*Hydrolycus armatus*	123	Moderate
	Nov 2021	*Cichla ocellaris*	169	Moderate

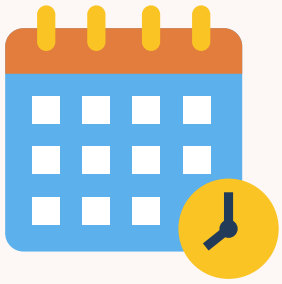
Achievements so far

1. A standardized survey design has been established using traditional fishing gears.
2. The surveys have covered a large range of sites and caught most of the more abundant local species, including those important to the fisheries.
3. The catch data provide size distributions for key species and the overall community. This data can support size-based stock assessments.
4. Catch Per Unit of Effort results could be used to initiate trend-based monitoring of the fishery, tracking the state of selected species and sites.
5. The empirical and model-based stock assessments both worked well and could form the basis for the ongoing assessment programme. Indications from the 2021 surveys are that the assessed stocks are not strongly overfished, although there is evidence of loss of larger individuals consistent with size-selective exploitation.



Challenges we faced

1. There can be many different local and Makushi names for the same species of fish; misnaming sometimes led to confusion for data analysis and stock assessment.
2. The 2020 and 2021 surveys used different gears, making it difficult to conclude which season might be more informative for determining fish stock state.
3. Population life history parameters are currently unavailable for the target stocks and currently need to be applied from other systems in the broader region.
4. Type of gear was not recorded for each individual fish in the datasheet. Consistency in methods and reporting will be extremely important for future surveys.
5. Stock assessment is technically challenging and involves a steep learning curve.



Plans for the future

1. We will collect growth and sexual maturity data for important target stocks to support more robust data-limited assessment models.
2. We will select indicator species that we will carefully monitor, for example species of greatest fishery and ecological interest.
3. We will discuss selection of survey sites and gears and how the data collected from these locations can support fisheries management. This discussion will help decisions concerning the most efficient season for the surveys and the most appropriate gears.
4. We will further train our teams in survey design and methods and data analysis.
5. We will extend the current analysis to compare fish stock state across different communities, especially between more pristine areas, e.g. Apoteri and areas where local depletion is expected, e.g. Kwaimatta, Katoka, Yakarinta and Yupukari.
6. We hope to include more local ecological knowledge to define historical baselines for fish stocks, i.e. population status before recent increases in exploitation.

Ten fish species found in the Rupununi River

Common name	Scientific name	Wapishana name	Makushi name	Photo
Dawalu	*Ageneiosus inermis*	Poroaba	Pîrapîrari	
Spermfish, balgo	*Ageneiosus ucayalensis*	Izowada	Kusuruyen	
Couti	*Brycon falcatus*	Kotii	Purumai	
Sword fish	*Boulengerella cuvieri*	Moroi	Moruwi	
Lukanani	*Cichla ocellaris*	Parizaba	Kamakara	
Sauw Sauw	*Curimata cyprinoides*	Dyaodyaoba	Sausau	
Whiskered/ Bearded dawalu	*Hypophthalmus marginatus*	Bioun	Aipayawa	
Baiara	*Hydrolycus armatus*	Daobaro	Paya	
Red/Cashew peari	*Pygocentrus nattereri*	Tobochi/ Pirin wuza'o/ Kaadaraba	Suyu aria	
Pacu	*Myloplus planquettei*	Awuzapa/ Waitau	Paku	

An aerial view of the fisheries team on the Rupununi River

The fisheries team preparing to head out and do a survey

Boats heading to the survey location on the Rupununi River

The survey team seen from a distance

NRDDB Community Fisheries Officer, Susan George setting a seine to begin the survey

North Rupununi District Development Board Fisheries Coordinator, Kevin Edwards collecting fish from a seine

Skilled hands carefully remove fish from a seine to avoid damage

A baiara *(Hydrolycus armatus)* being weighed safely through its gill

Susan George inspecting a fish's gender and taking data before release

A dawalu *(Ageneiousus indermis)* being measured for the survey

A ranger softly strokes a fish to "revive" it before release to prevent drowning

View of Kwatamang landing and rangers returning from a survey

Dr Sam Shephard delivering fish stock assessment training–at the Bina Hill Institute

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