CO-OCCURRENCE DYNAMICS OF FISH SPECIES IN FRESHWATER ECOSYSTEMS: IMPLICATIONS FOR ARTISANAL FISHING IN HYDROELECTRIC DAM-IMPACTED REGIONS

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SUPPLEMENTARY MATERIAL

Table S1: This table presents species groups along with their corresponding species names, scientific names, and families. In some cases, species or families could not be identified due to limitations in the information provided by local fishers' common names. For those groups where identification was not possible, either the species or family names are absent.

Vernacular Species Group	Possible Local Species	Species Family
Acará	*Astronotus ocellatus* , *Caquetaia spectabilis* , *Retroculus xinguensis* , *Satanoperca spp.* , *Geophagus gr. altifrons* , *Geophagus argyrosticus*	Cichlidae, Cichlidae, Cichlidae, Cichlidae, Geophagidae, Geophagidae
Acari	*Hypostomus plecostomus* , *Pterygoplichthys pardalis* , *Pterygoplichthys xinguensis*	Loricariidae, Loricariidae, Loricariidae
Acari Amarelinho	*Baryancistrus xanthellus*	Loricariidae
Aracu	*Hypomasticus julii* , *Anostomoides passionis* , *Anostomus ternetzi* , *Laemolyta fernandezi* , *Laemolyta proxime* , *Leporellus vittatus* , *Leporinus aff. fasciatus* , *Leporinus friderici* , *Petulanos intermedius* , *Schizodon vittatus*	Doradidae, Anostomidae, Anostomidae, Curimatidae, Curimatidae, Anostomidae, Anostomidae, Anostomidae, Anostomidae, Anostomidae
Ariduia	*Semaprochilodus brama* , *Semaprochilodus insignis*	Prochilodontidae
Arraia	*Paratrygon aiereba* , *Paratrygon spp.* , *Potamotrygon leopoldi* , *Potamotrygon orbygnyi*	Potamotrygonidae
Babão	*Brachyplatystoma platynemum*	Pimelodidae
Barba Chata	*Pinirampus pirinampu*	Pimelodidae
Bicuda	*Boulengerella cuvieri* , *Boulengerella maculata*	Cichlidae
Braço de Moça	*Platystomaticthys sturio*	Pimelodidae
Cachorra	*Hydrolycus armatus* , *Hydrolycus tatauaia* , *Cynodon gibbus* , *Rhaphiodon vulpinus*	Cynodontidae
Curimatã	*Prochilodus nigricans*	Prochilodontidae
Erana	*Argonectes robertsi* , *Bivibranchia spp.* , *Hemiodus spp.*	Asterophysidae, Asterophysidae, Hemiodidae
Fidalgo	*Ageneiosus inermis* , *Auchenipterus nuchalis*	Auchenipteridae
Mandi	*Pimelodus blochii* , *Pimelodus ornatus*	Pimelodidae
Matrinxã	*Brycon falcatus*	Characidae
Pacu	*Myloplus arnoldi* , *Myloplus rubripinnis* , *Myloplus schomburgkii* , *Myloplus rhomboidalis* , *Mylossoma duriventris* , *Myleus setiger*	Serrasalmidae
Pescada	*Pachyurus junkii* , *Pachyurus schomburgkii* , *Plagioscion squamosissimus*	Sciaenidae
Piranha	*Serrasalmus rhombeus* , *Serrasalmus manueli* , *Pygocentrus nattereri*	Serrasalmidae
Pocomon	*Tocantinsia piresi*	Curimatidae
Pirarara	*Phractocephalus hemiolopterus*	Pimelodidae
Surubim	*Pseudoplatystoma punctifer*	Pimelodidae
Tucunaré	*Cichla melaniae* , *Cichla*	Cichlidae
Trairão	*Hoplias aimara* , *Hoplias curupira*	Erythrinidae
Traíra	*Hoplias malabaricus*	Erythrinidae

Table S2: *Total fish catches (kg) by species, fishing gear, boat type, and average fishing duration across regions and periods (2012-2020). The most captured species in each region and period are highlighted.*

REGION	PERIOD 2012-2015 (Kg)	PERIOD 2016-2020 (Kg)	MOST CAPTURED SPECIES (2012-2015)	MOST CAPTURED SPECIES (2016-2020)	TOTAL CATCH BY SPECIES (2012-2015)	TOTAL CATCH BY SPECIES (2016-2020)	AVERAGE NUMBER OF FISHERS (2012-2015)	AVERAGE NUMBER OF FISHERS (2016-2020)	MOST FREQUENT BOAT (2012-2015)	MOST FREQUENT BOAT (2016-2020)	MOST FREQUENT FISHING GEAR (2012-2015)	MOST FREQUENT FISHING GEAR (2016-2020)	AVERAGE FISHING DURATION (2012-2015)	AVERAGE FISHING DURATION (2016-2020)
UPSTREAM	1115.90	473.50	TUCUNARÉ	PACU	TUCUNARÉ (254.5 kg), OTHERS (861.4 kg)	PACU (148.5 kg), OTHERS (325 kg)	1.2	1.4	RABETA	RABETA	LINE	NETS	1.1 days	1.2 days
RESERVOIR	468.50	1174.00	PACU	PACU	PACU (114 kg), OTHERS (354.5 kg)	PACU (315 kg), OTHERS (859 kg)	1.2	1.5	RABETA	RABETA	LINE	LINE	1.2 days	1.8 days
DE-WATERED	40.00	148.30	CURIMATA	PACU	CURIMATA (12 kg), OTHERS (28 kg)	PACU (66.5 kg), OTHERS (81.8 kg)	1.8	1.4	RABETA	RABETA	LINE	OTHERS	1.5 days	1.4 days
DOWNSTREAM	6818.11	3741.62	PESCADA	PESCADA	PESCADA (1,415.4 kg), OTHERS (5,402.71 kg)	PESCADA (932 kg), OTHERS (2809,62 kg)	1.4	1.3	RABETA	RABETA	REDS	NETS	1.1 days	1.1 days
TOTAL (Kg)	**8442.51**	**5537.42**												

Reservoir Networks

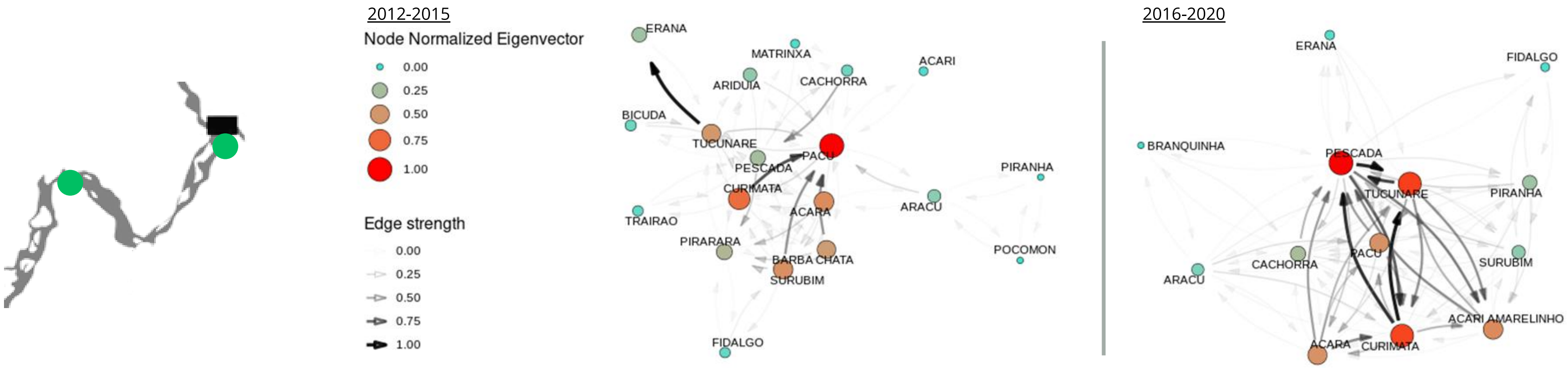

***Fig. S1**:* Interaction networks in the 'reservoir' region 2012-2015 and 2015-2016 periods of the Belo Monte Hydroelectric Plant. Species are represented as circles, with colors close to 1 indicating greater importance based on eigenvector centrality. Larger, more orange circles represent greater eigencentrality, while smaller, greener circles indicate lower values. Connections between species during fishing seasons are represented by arrows, with darker shades representing stronger co-occurrence between two species. In the side maps the location of each reach is highlighted.

Downstream Networks

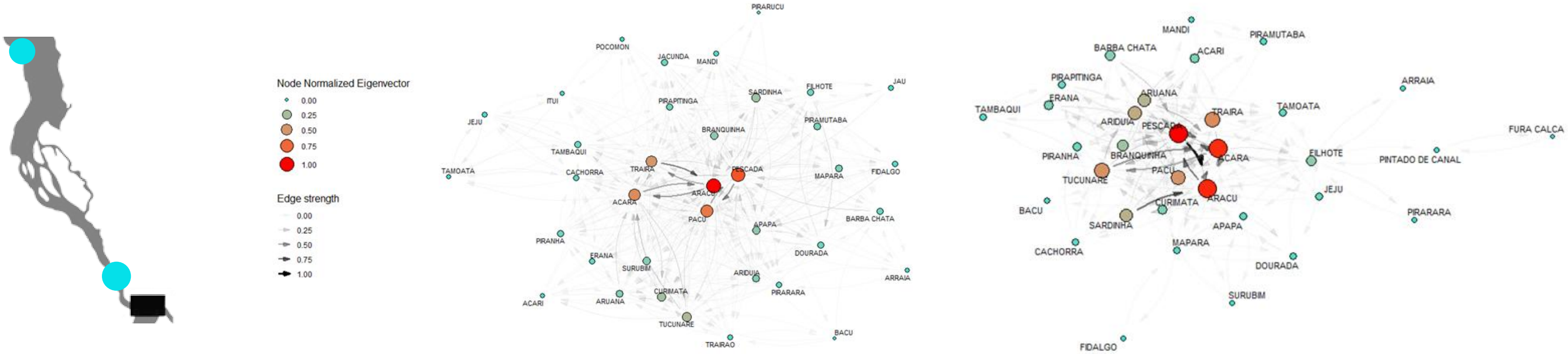

Fig. S2: Interaction networks in the ‘reservoir’ region 2012-2015 and 2015-2016 periods of the Belo Monte Hydroelectric Plant. Species are represented as circles, with colors close to 1 indicating greater importance based on eigenvector centrality. Larger, more orange circles represent greater eigencentrality, while smaller, greener circles indicate lower values. Connections between species during fishing seasons are represented by arrows, with darker shades representing stronger co-occurrence between two species. In the side maps the location of each reach is highlighted.

SUPPLEMENTARY MATERIAL – SIMULATED NETWORKS

Upstream Networks

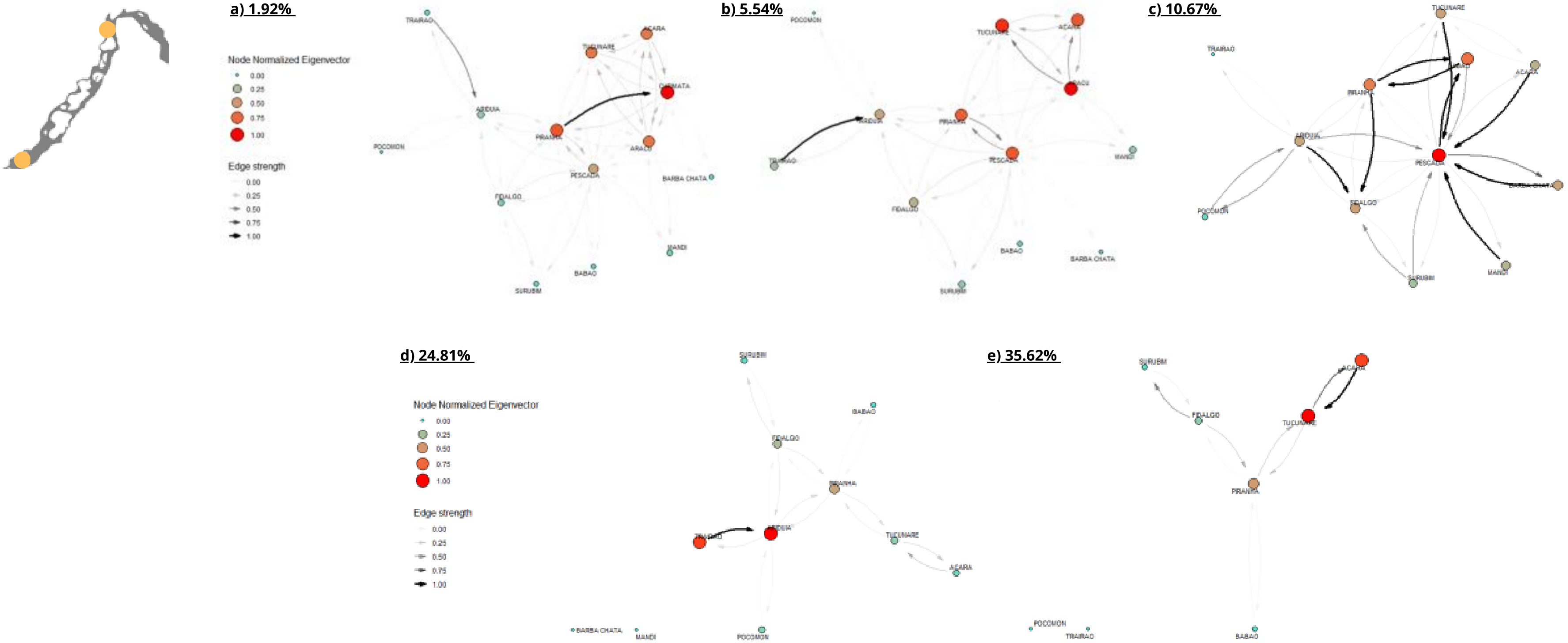

Fig. S3: Simulated networks in the 'upstream' of the Belo Monte Hydroelectric Plant. The subfigures show the percentage differences between the original network (2016-2020) and the simulated networks with the exclusion of key species: a) 1.92%, b) 5.54%, c) 10.67%, d) 24.81%, and e) 35.62%. Species are represented as circles, with larger, more orange circles indicating greater eigenvector centrality and smaller, greener circles indicating lower centrality. Connections between species during fishing seasons are represented by arrows, with darker shades indicating stronger co-occurrence. The side maps highlight the location of each reach.

De-watered Networks

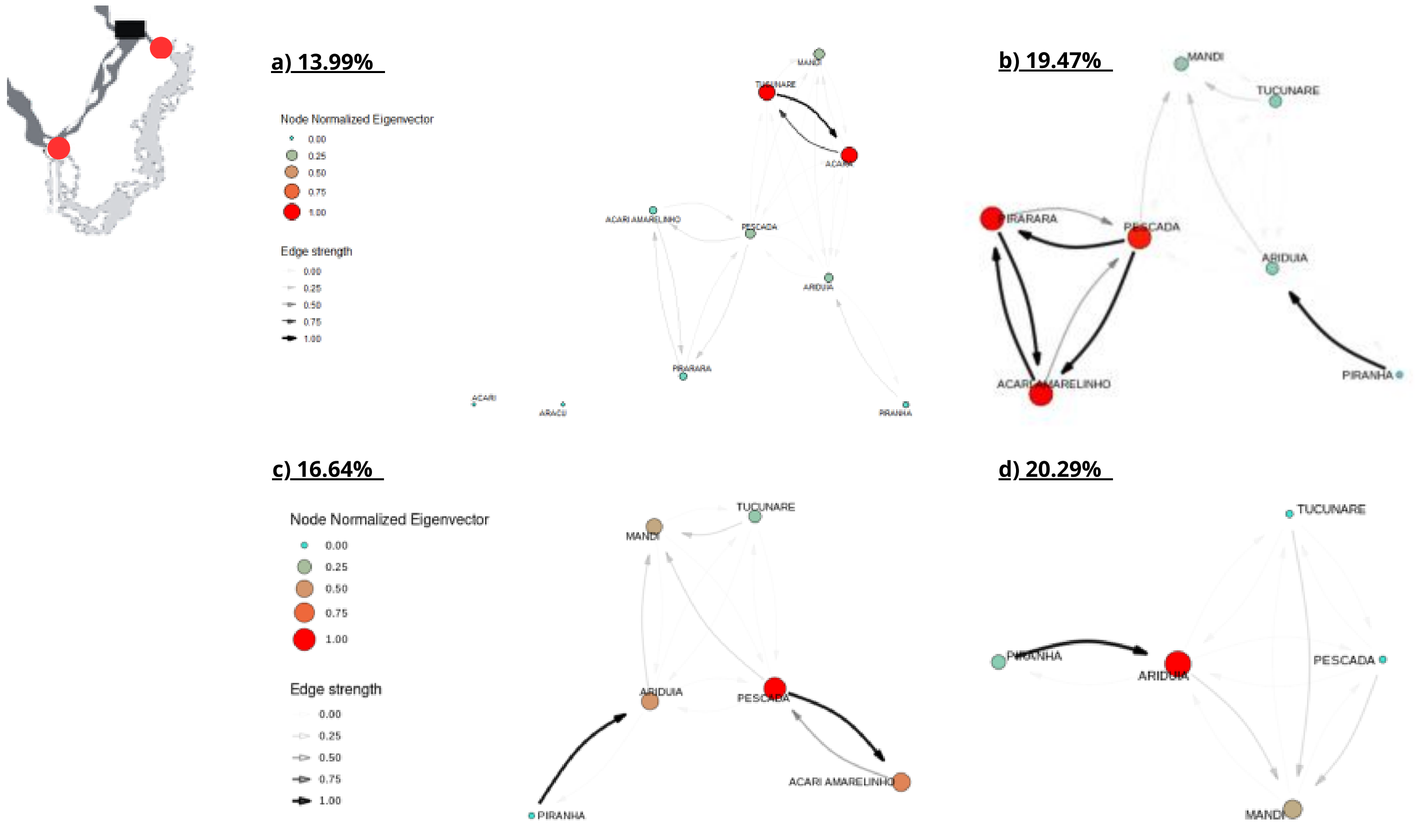

Fig. S4*:* Simulated networks in the 'de-watered' of the Belo Monte Hydroelectric Plant. The subfigures show the percentage differences between the original network (2016-2020) and the simulated networks with the exclusion of key species: a) 13.99%, b) 19.47%, c) 16.64% and d) 20.29%. Species are represented as circles, with larger, more orange circles indicating greater eigenvector centrality and smaller, greener circles indicating lower centrality. Connections between species during fishing seasons are represented by arrows, with darker shades indicating stronger co-occurrence. The side maps highlight the location of each reach.

Reservoir Networks

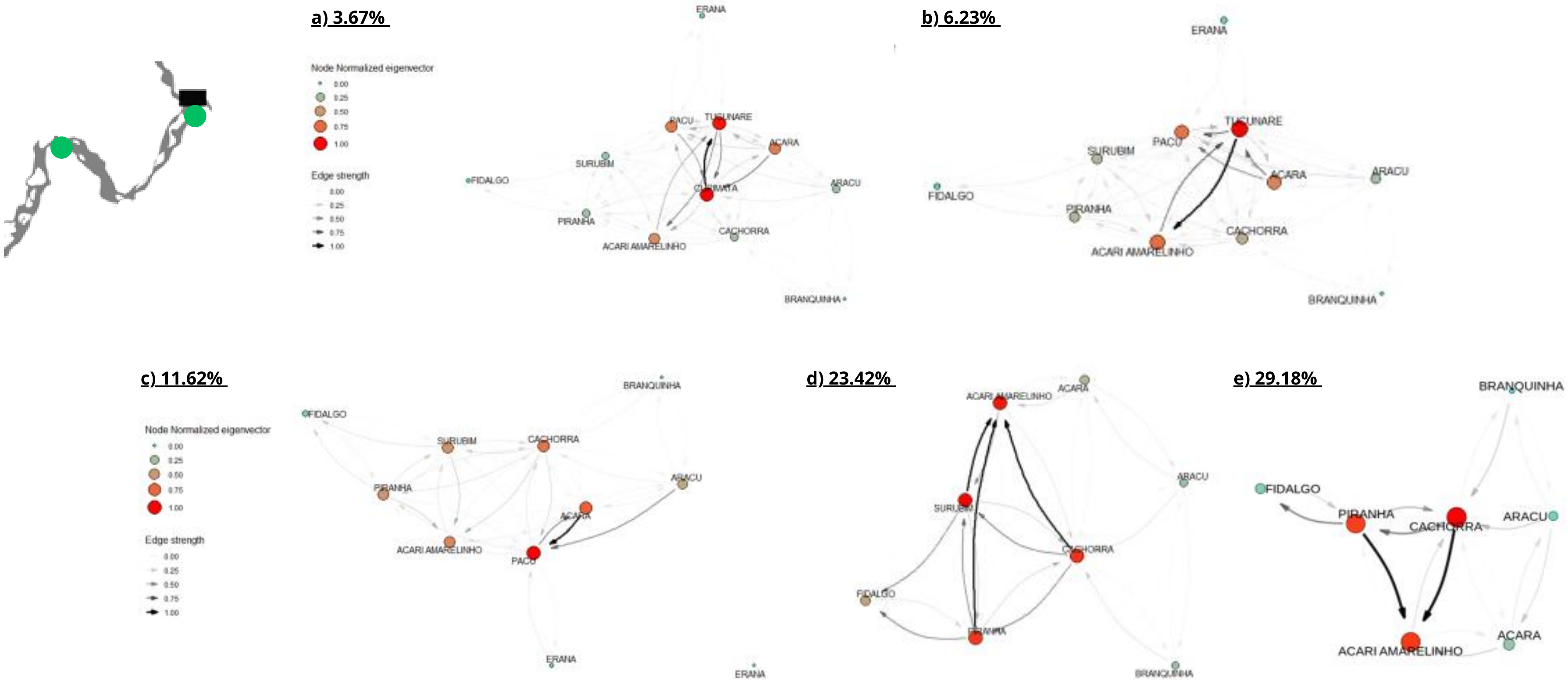

Fig. S5*:* Simulated networks in the 'reservoir' of the Belo Monte Hydroelectric Plant. The subfigures show the percentage differences between the original network (2016-2020) and the simulated networks with the exclusion of key species: a) 3.67%, b) 6.23%, c) 11.62%, d) 23.42%, and e) 29.18%. Species are represented as circles, with larger, more orange circles indicating greater eigenvector centrality and smaller, greener circles indicating lower centrality. Connections between species during fishing seasons are represented by arrows, with darker shades indicating stronger co-occurrence. The side maps highlight the location of each reach.

Downstream Networks

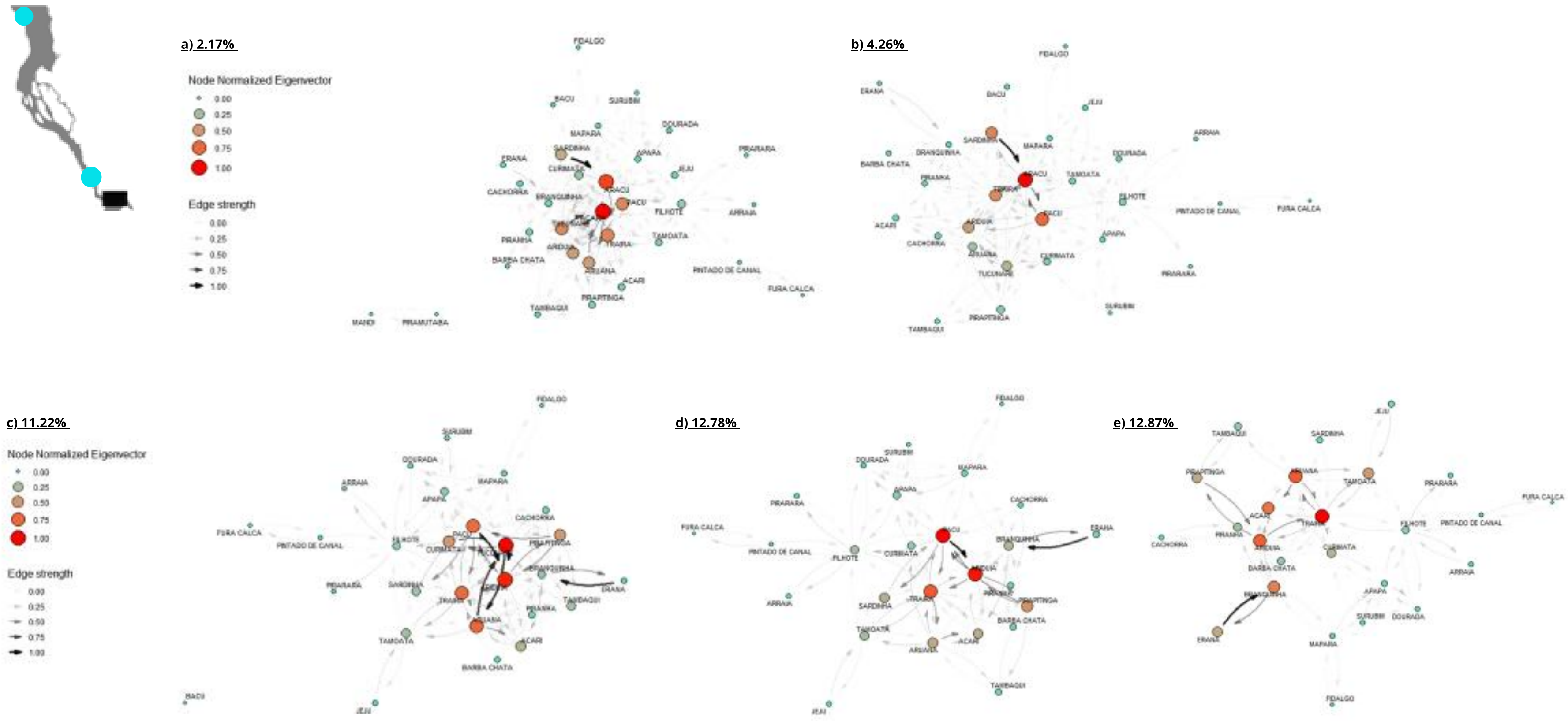

Fig. S6: Simulated networks in the 'downstream' of the Belo Monte Hydroelectric Plant. The subfigures show the percentage differences between the original network (2016-2020) and the simulated networks with the exclusion of key species: a) 2.17%, b) 4.26%, c) 11.22%, d) 12.78%, and e) 12.87%. Species are represented as circles, with larger, more orange circles indicating greater eigenvector centrality and smaller, greener circles indicating lower centrality. Connections between species during fishing seasons are represented by arrows, with darker shades indicating stronger co-occurrence. The side maps highlight the location of each reach.