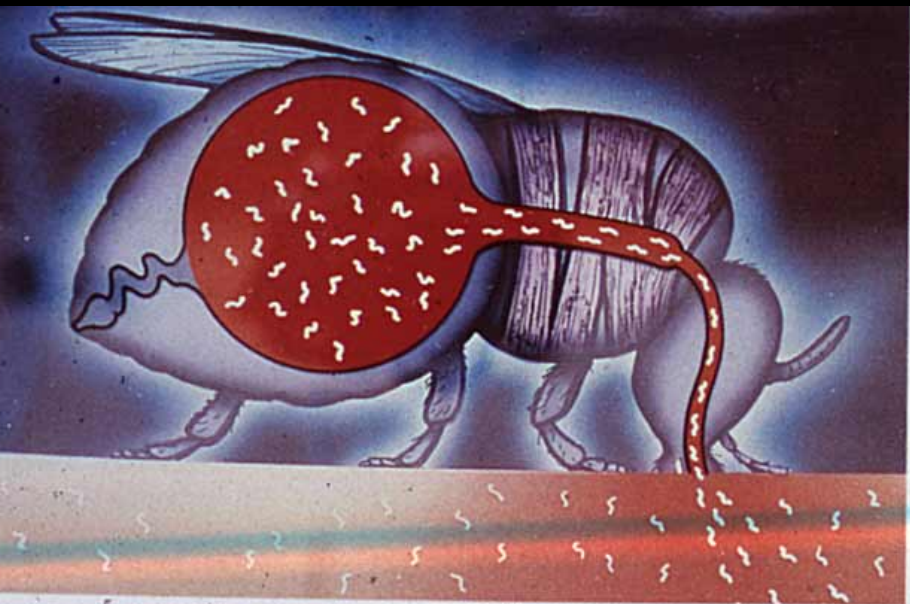




Onchocerciasis = river blindness

- caused by the parasitic roundworm *Onchocerca volvulus*
- transmitted by female black flies of the *Simulium damnosum* complex
- Solution: control the vector (the black fly)
- Solution: control the parasite through chemotherapy with ivermectin






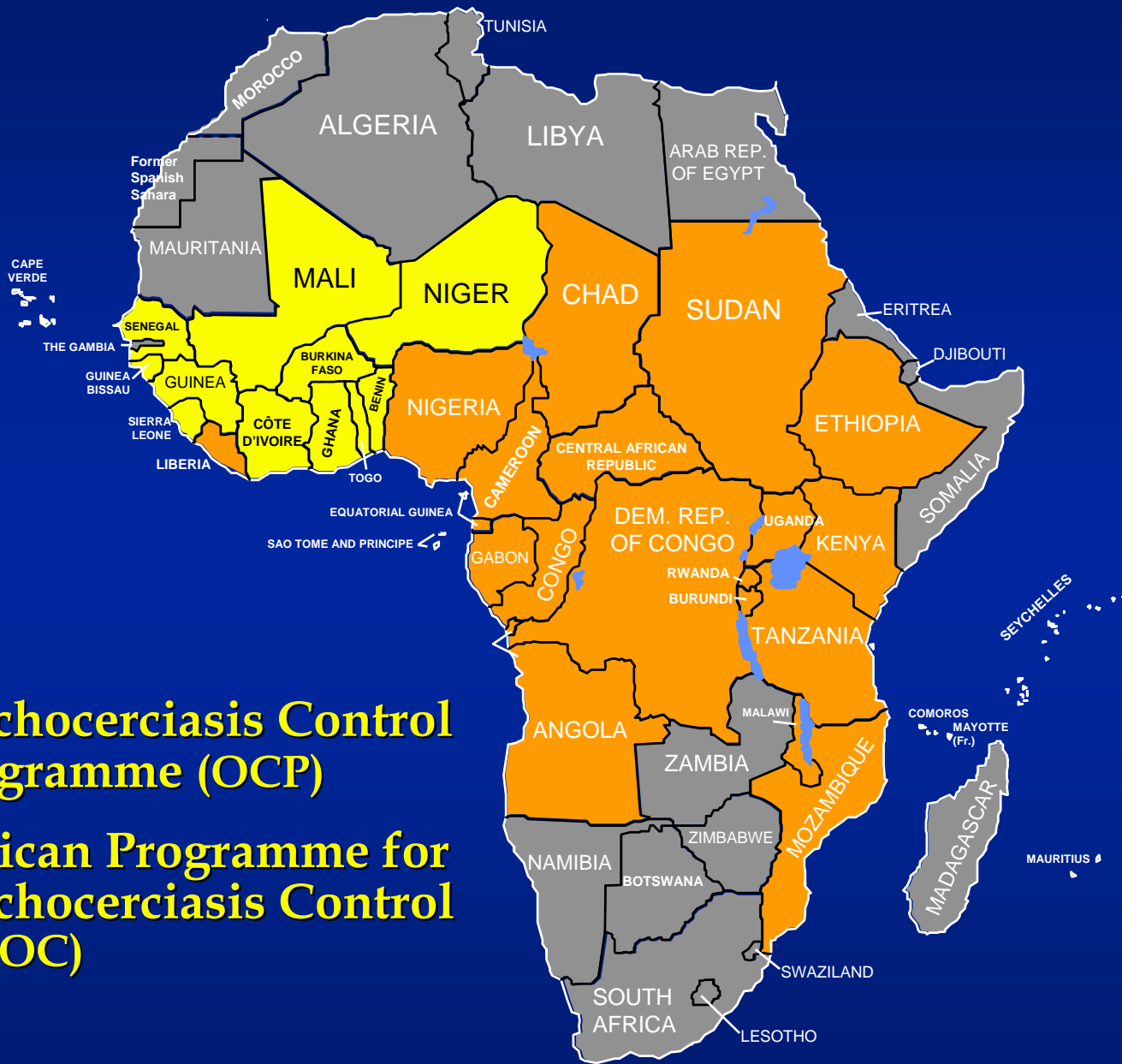


Control of Onchocerciasis

- United Nations Development Program, World Bank, and World Health Organization funded the *Onchocerciasis Control Program* in 11 West African countries, 1974-2002 (extended to 2007)
- Goal: Control river blindness, resettle abandoned valleys, increase food and crop production, raise GNP, and reduce severity of future droughts
- *African Program for Onchocerciasis Control* in 19 central African countries, 2000-2010
- Goal: Disease elimination through drug therapy

 **Onchocerciasis Control Programme (OCP)**

 **African Programme for Onchocerciasis Control (APOC)**

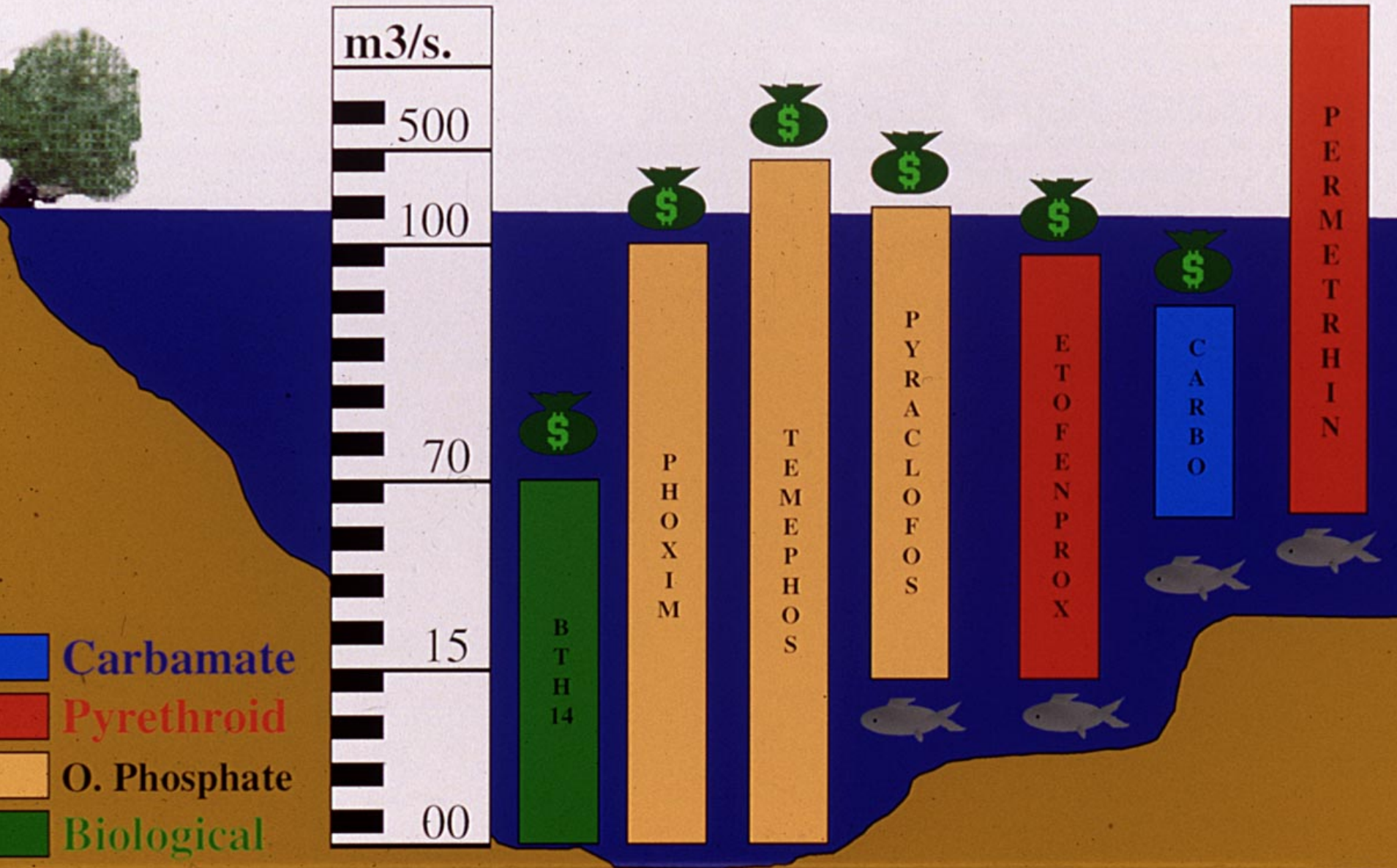


Strategy of Vector Control: The First Approach

- stop black fly transmission of parasite to humans
- over time, the human “reservoir” of parasites decreases
- 9-11 year parasite life cycle, 14-20 years of insecticide applications needed
- 30,000 miles of river sprayed weekly

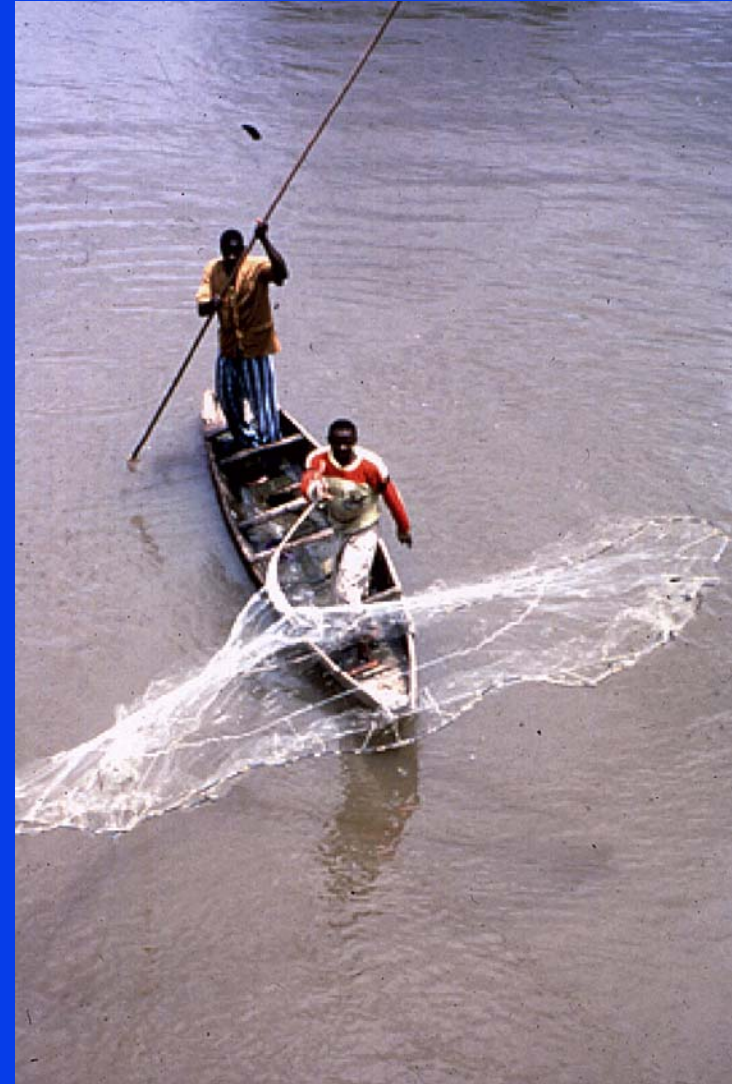


Operational Range of larvicides used by OCP

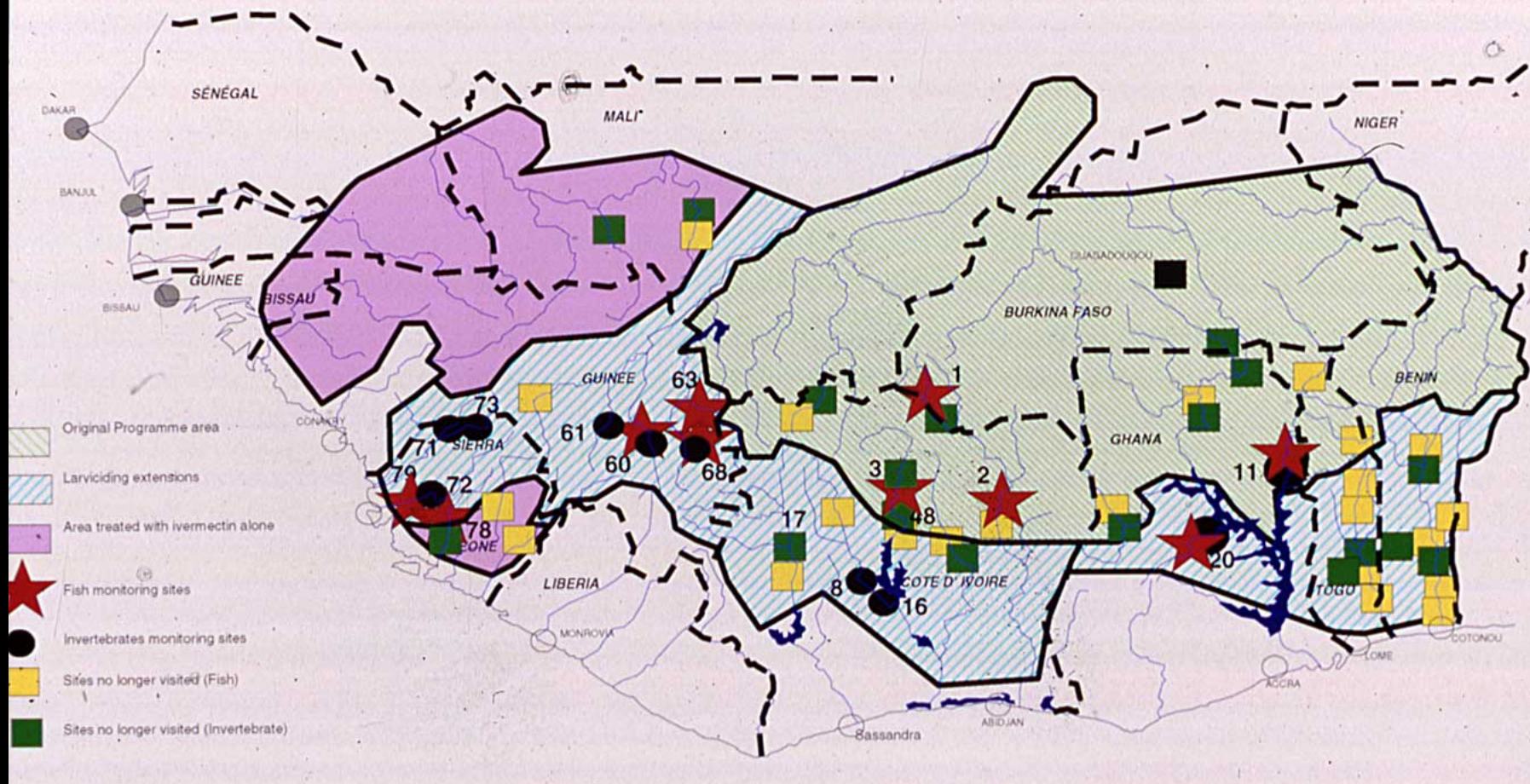




Fish are the Essential
Protein Source in this
Region



AQUATIC MONITORING SITES



Evaluation of Fish

- species richness and composition
- catch per unit effort
- size distribution
- population densities
- condition factor (length-weight relationship)

Evaluation of Benthic Macroinvertebrates

- species richness and composition
- densities
- night-time invertebrate drift patterns
- recovery of sensitive species
- toxicity tests (black flies and non-target organisms)





Socio-Economic Impact of Controlling River Blindness

- onchocerciasis is no longer a disease of public health importance
- 25 million onchocerciasis-free hectares (67.5 million acres) are now being resettled
- food production has increased to support 17 million additional people



BURKINA FASO ' S SIDE OF THE LERABA RIVER

What is the environmental sustainability of resettlement in onchocerciasis-free areas?

- resettlement is spontaneous, little infrastructure such as schools or roads exist
- settlers try to occupy largest possible areas
- few sustainable soil, water, fisheries, or crop-management techniques are practiced

Habitat Assessments

- conducted at all sites where fish and benthic macroinvertebrates are collected
- existing habitat is compared to descriptions that describe optimal, suboptimal, marginal, or poor conditions
- within each category, a high, medium, or low score is applied

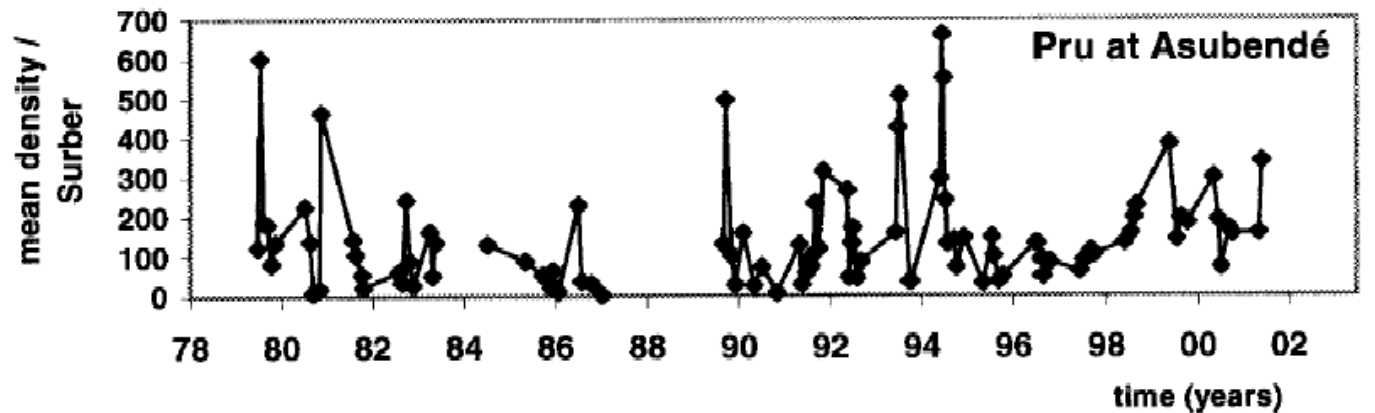
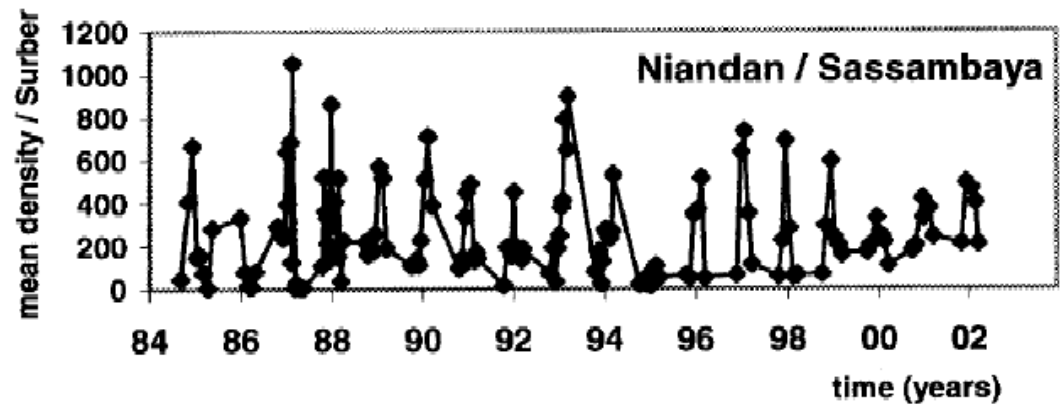
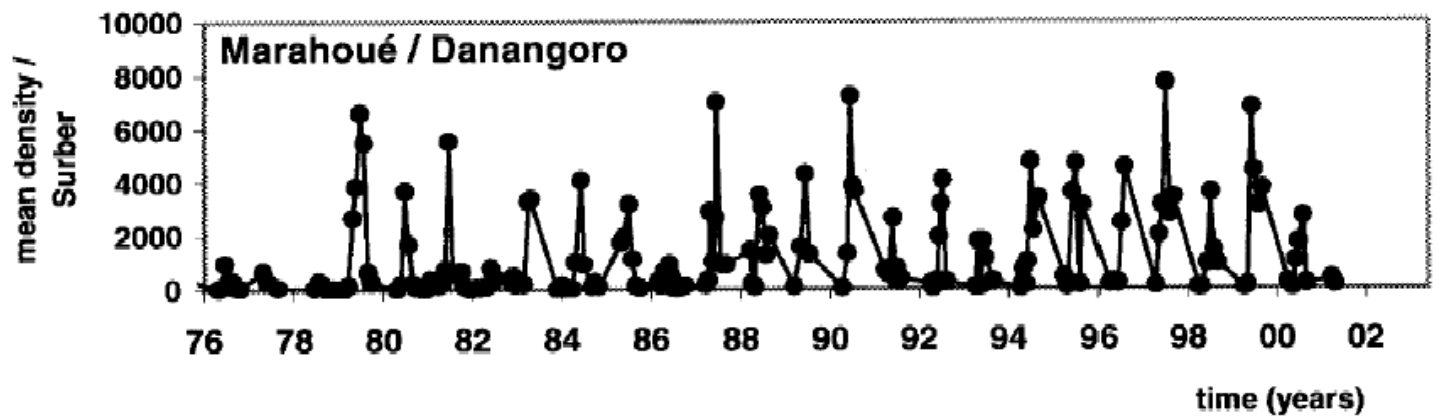


Figure 7. Long-term changes in the density of invertebrates on the rocks, as estimated using Surber samplers, in selected monitoring stations.

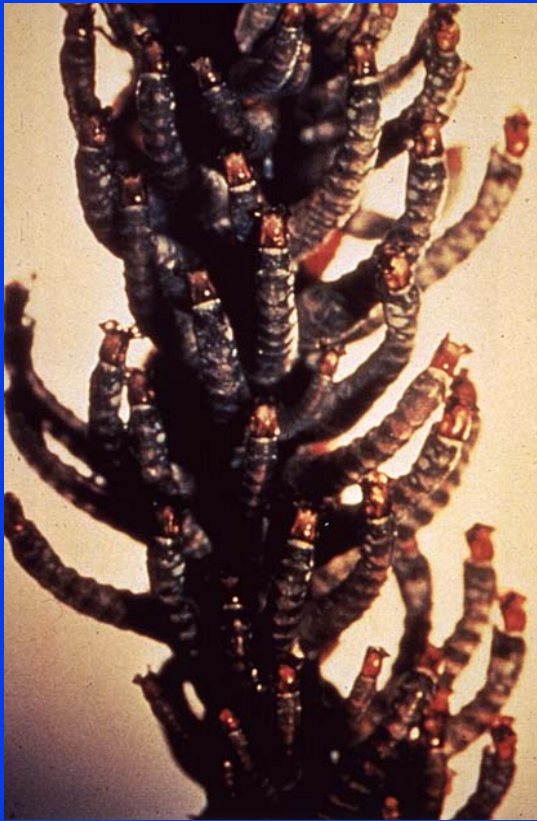
At the program's inception an
“environmental catastrophe”
resulting from the large-scale,
long-term applications of
insecticides to West African
Rivers was feared

Were the fears justified?

Concepts of River Zonation

- Fish and invertebrate communities occur in different river zones
- Therefore, application of insecticides could eliminate taxa and change ecological status
- *However, in African rivers, there are no species replacements; species richness increases downstream*
- *Species are distributed over large areas; recolonization potential is high*

Insect life cycles in tropical Africa were unknown



- *4-12 weeks for hydropsychid caddisflies and dragonflies*
- *Adult life of aquatic insects is longer*
- *Recolonization occurs more rapidly than expected*

Boundary Layer Concept

- Boundary layer is 1-3 mm thick; affects contact and uptake of insecticides
- Non-target benthos should have higher uptake than black fly larvae
- *Flow is complicated; boundary layer is transient and very thin*
- *Insecticide contact should be higher for black flies than for non-target organisms*



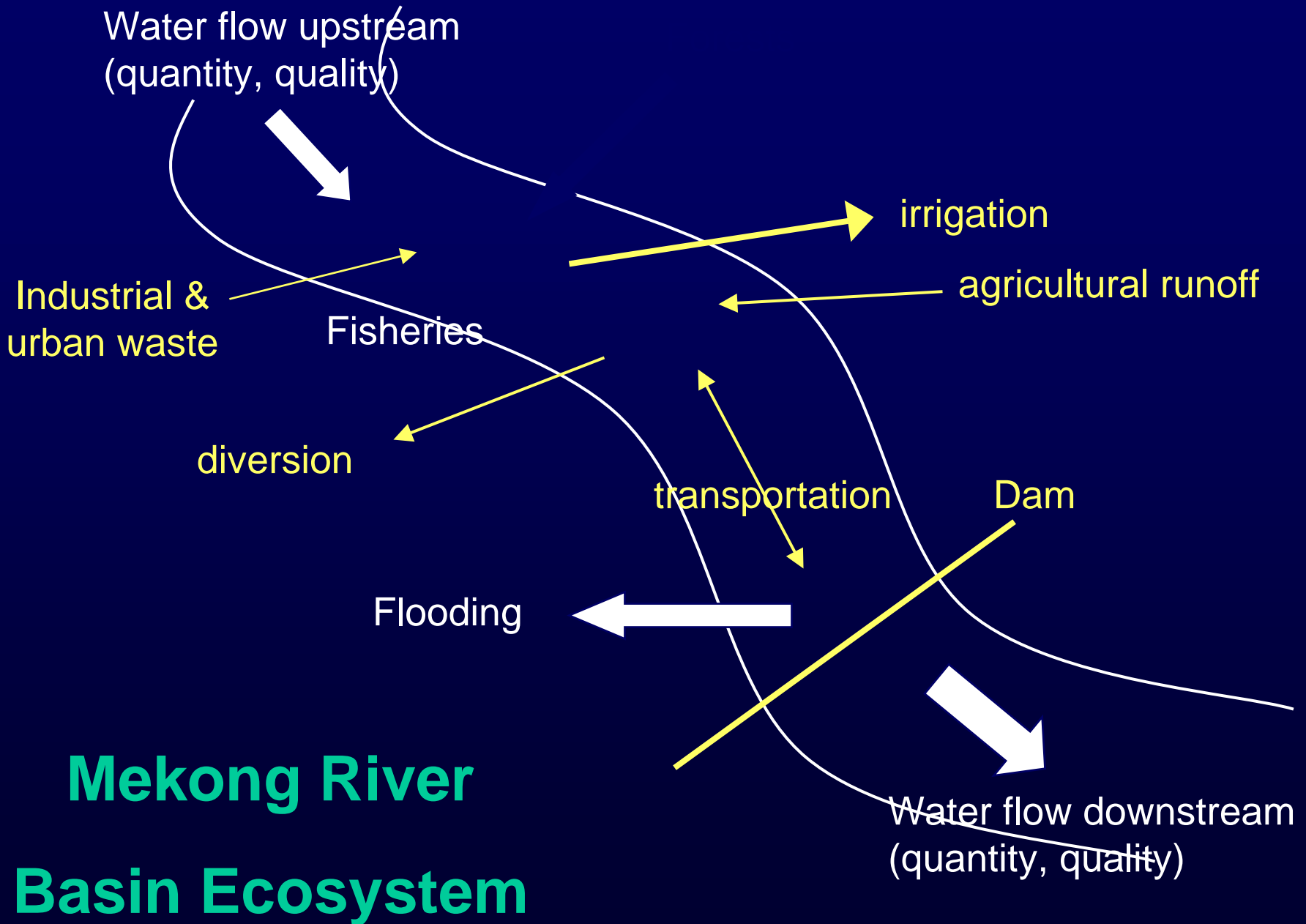
SIMULIUM

Rivers are in an equilibrium
condition

*Rivers are driven by disturbance, no
steady state or equilibrium*

Monitoring was based entirely on
on fish and macroinvertebrates

- *Dynamic aspects of river discharge, metapopulations, and biota should be studied as part of an overall assessment*
- *Today, a systems approach would be used (Mekong River Commission)*



Mekong River: Evaluating Effects of Large Dams

- Biological Assessment
- In-stream flows
- Ecological risk assessment
- Water quality
- Sediment toxicity



Bioassessment

- Fish
- Benthos
- Zooplankton
- Algae
- Macrophytes
- Primary Production
- Respiration

Lessons Learned from West African Biomonitoring

- Large-scale programs start from political decisions, not necessarily with a scientific basis
- Programs hindered by what cannot be done (higher-level identifications) and tradition (sampling devices)
- Monitoring can only tell us so much; a complementary research program reveals underlying effects



Outcomes of Onchocerciasis Control

- African Program for Onchocerciasis Control now in 19 more countries (ivermectin only, Merck donation)
- coordinate distribution of drugs for lymphatic filariasis (SKB donation)
- potential distribution of anti-malaria nets
- reductions in parasitic-induced anemia

