

# Peace River Cumulative Impact Study



**DEP Bureau  
of Mine Reclamation.**





# Historical and Modern Patterns of Fish Species from Freshwater through the Tidal Peace River Continuum.

By

Thomas H. Fraser

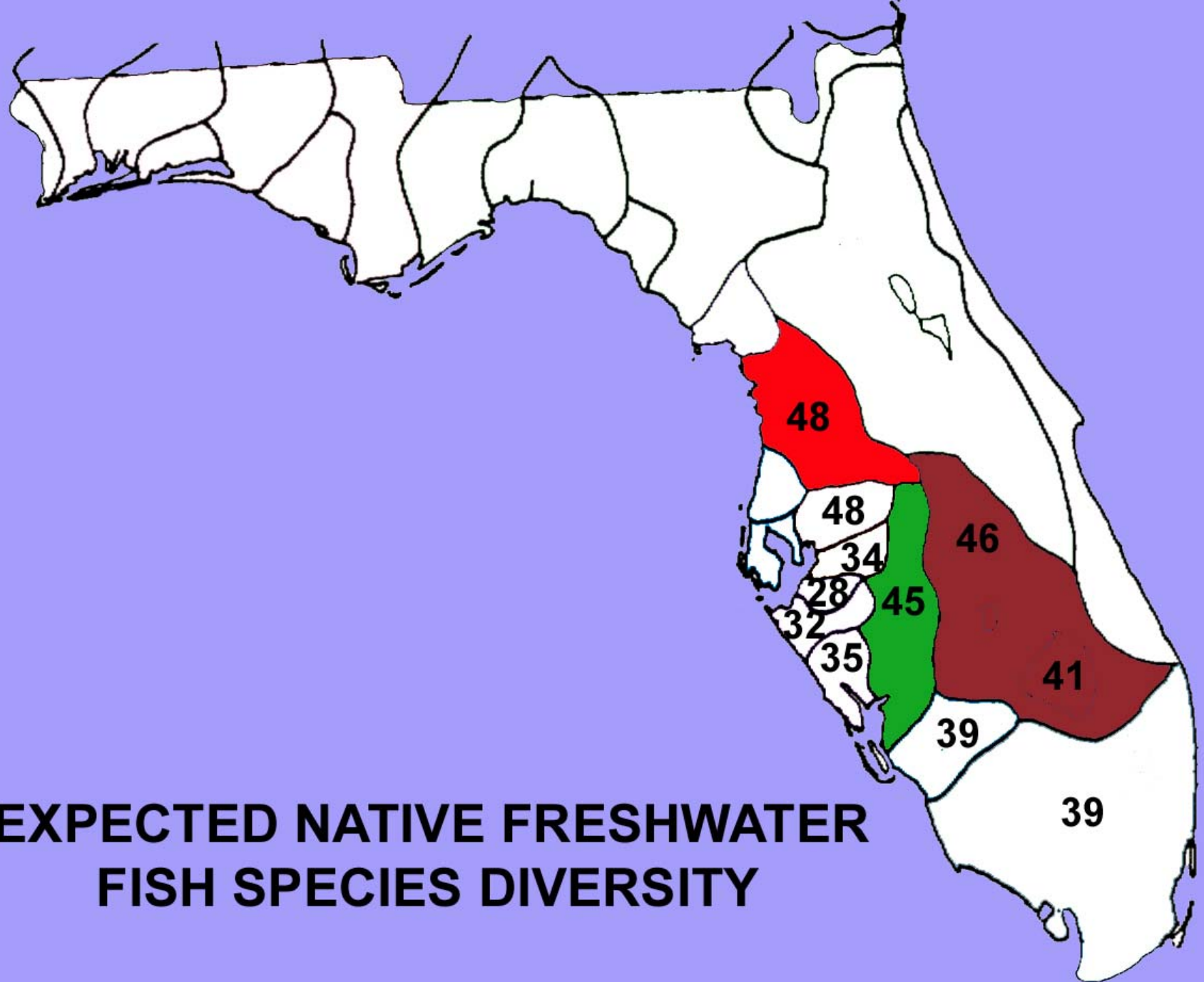
W. Dexter Bender & Associates, Inc.

# SOURCES OF INFORMATION

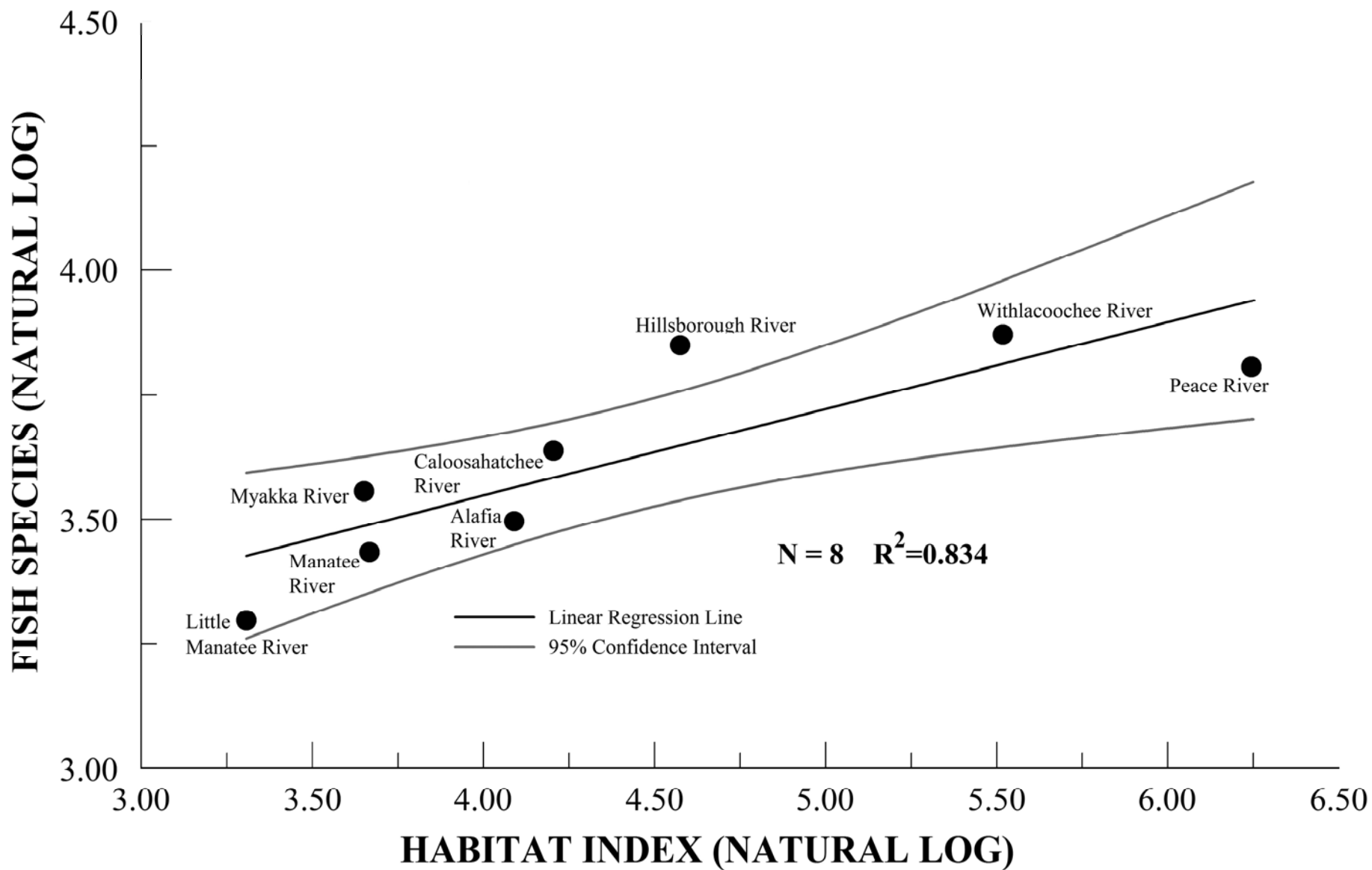
- **PRIMARY & SECONDARY LITERATURE**
  - CHECKLISTS
  - PUBLISHED RECORDS
- **SPECIMENS IN NATURAL HISTORY MUSEUMS**
  - UNIVERSITY OF FLORIDA
  - TULANE UNIVERSITY
  - NATIONAL MUSEUM OF NATURAL HISTORY
  - CALIFORNIA ACADEMY OF SCIENCES
  - UNIVERSITY OF MICHIGAN
  - CORNELL UNIVERSITY
  - HARVARD UNIVERSITY
  - PHILADELPHIA ACADEMY OF SCIENCES
- **DISTRIBUTION PATTERNS**
  - MUSEUM DATA
  - LITERATURE

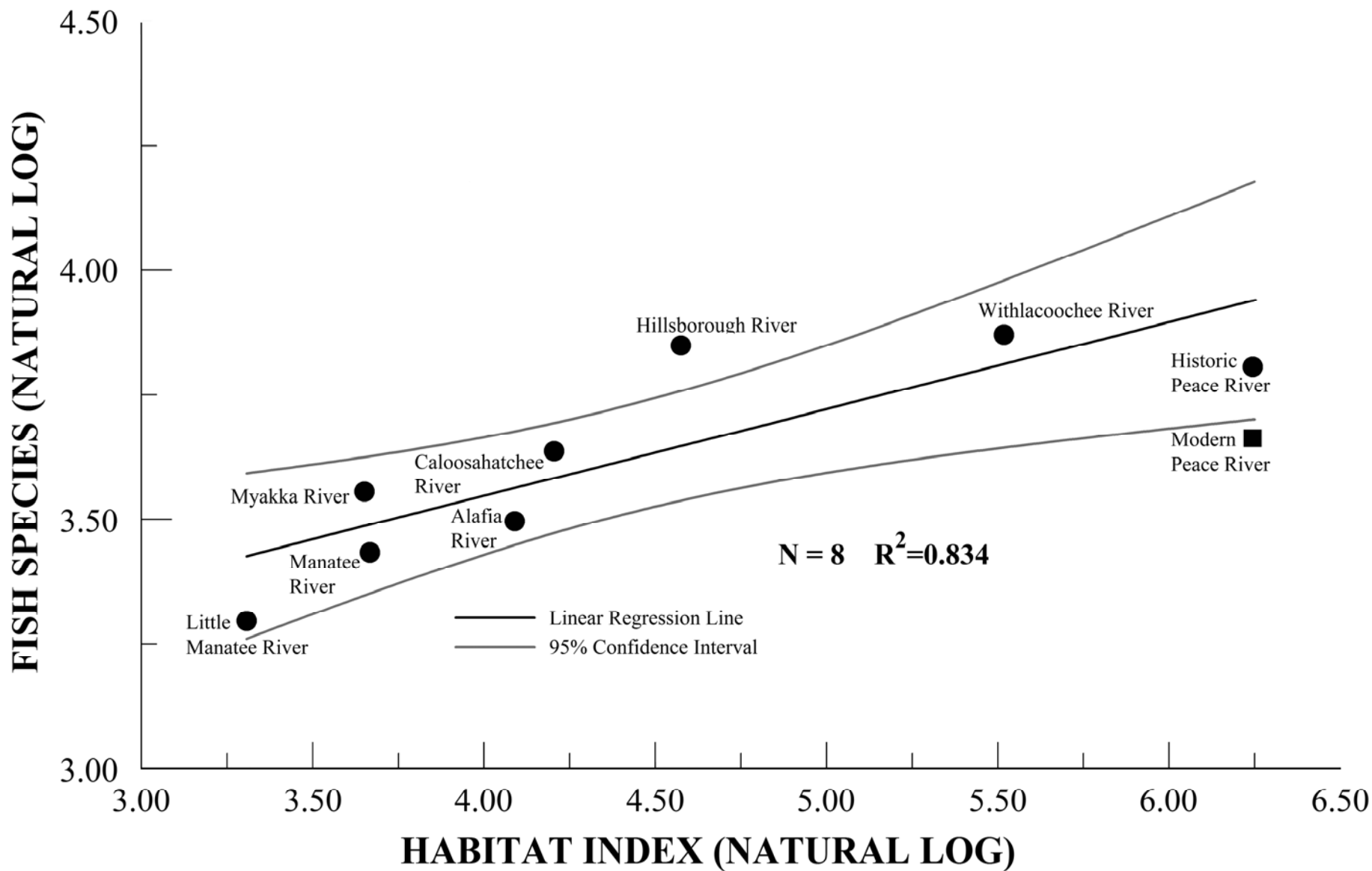
# FISH COLLECTIONS – PEACE RIVER WATERSHED

- UNIV. OF INDIANA 1890 & 1891
- PHILADELPHIA ACADEMY OF SCIENCE 1937-43
- SMITHSONIAN INSTITUTION 1946
- UNIV. OF MIAMI 1958-1959
- TULANE UNIV. 1950s & mid 1960s
- FLORIDA STATE UNIV. 1950s & mid 1960s
- UNIV. OF FLORIDA 1989-2004
- GAME & FRESHWATER FISH COMMISSON 1963 – 1992
  - continuous sampling from 1983-1992 along main stem
- FPL/TEXAS INSTRUMENTS 1976 (January – October)
  - weekly to monthly DeSoto / Hardee County line south
- FISH & WILDLIFE RESEARCH INSTITUTE 1989 – 2003
  - monthly in Charlotte Harbor and tidal Peace River
- OTHER MATERIAL – DRIs, EISs & PERMITS 1975 - 2004



**EXPECTED NATIVE FRESHWATER  
FISH SPECIES DIVERSITY**





LAKE  
HANCOCK →

UPPER PEACE RIVER

Wachula, Florida



Image © 2005 DigitalGlobe  
Image © 2005 EarthSat

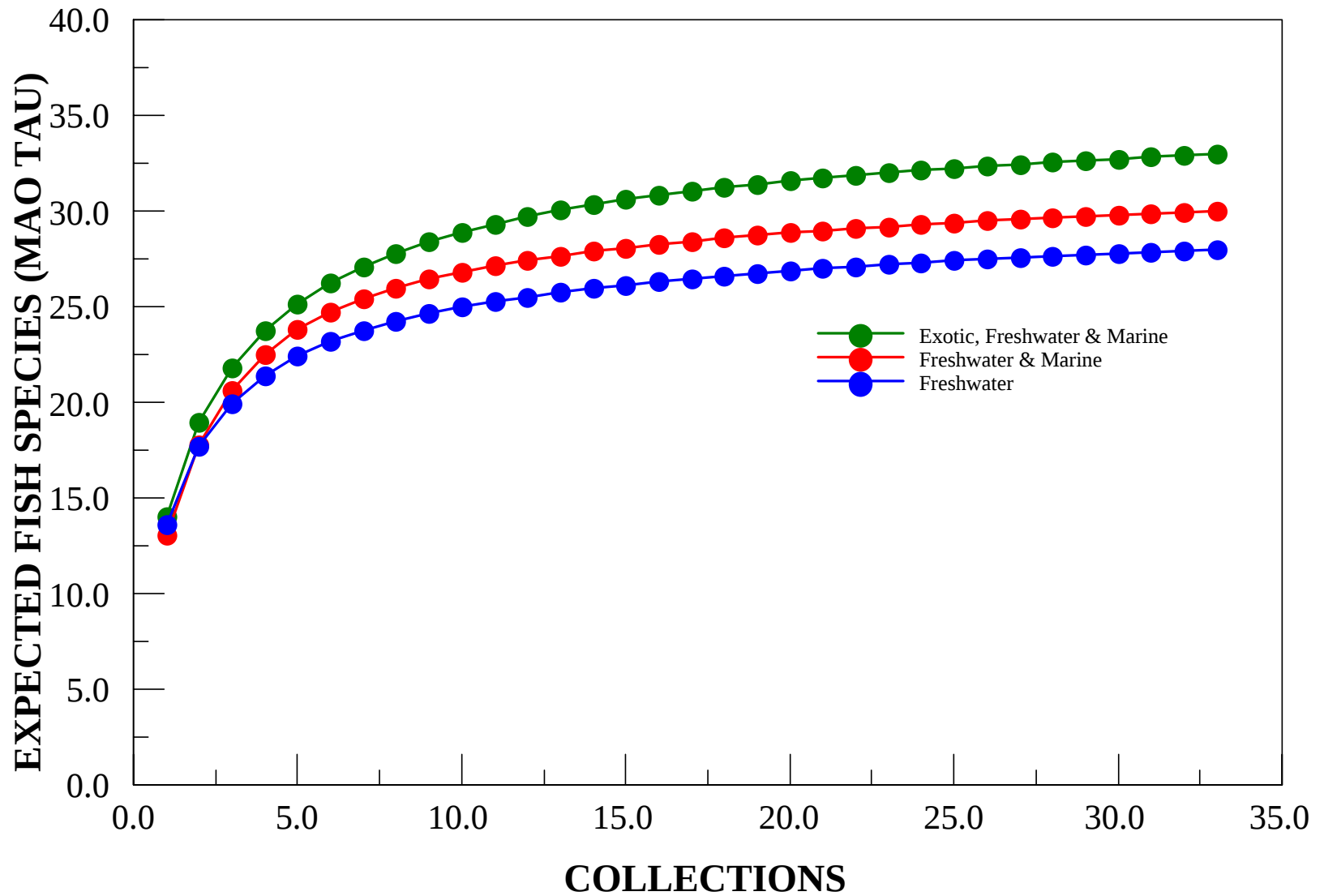
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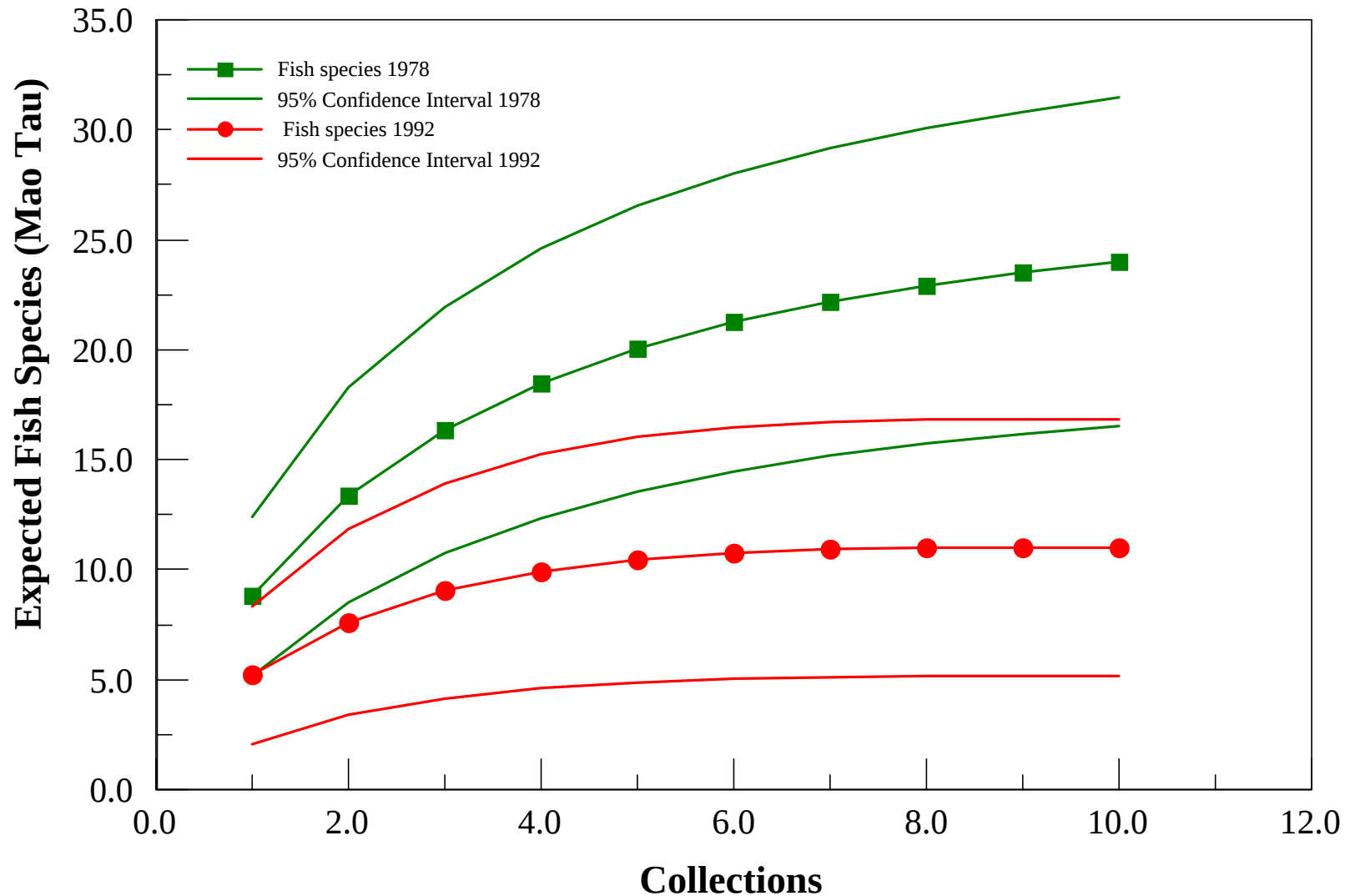
Streaming 100%

Eye alt 10.00 mi

**FISH SPECIES FROM UPPER REGION OF THE PEACE RIVER  
(WACHULA, FT. MEADE & HOMELAND: GFC DATA, 1983-1991).**



**Fish species collected in Payne Creek Watershed in 1978 & 1992 for phosphate activities. 100 randomizations of collections, with replacement.**



# WHIDDEN CREEK

Image © 2005 DigitalGlobe

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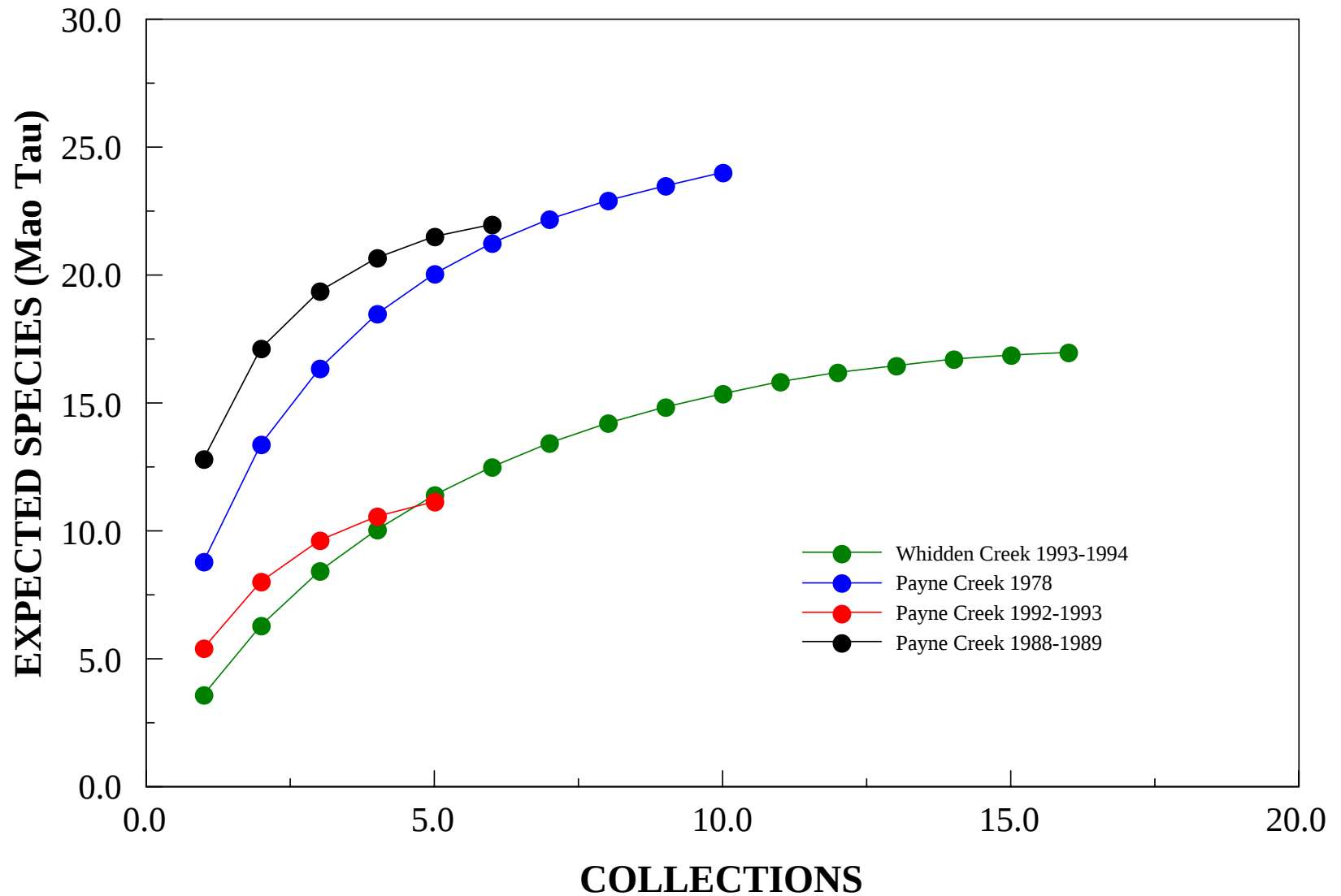


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Streaming 100%

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**FISH SPECIES FOR WHIDDEN CREEK (1993-1994) & PAYNE CREEK  
1978, 1988-1989 & 1992-1993. 100 randomizations with replacement.**



# NOCATEE - GARDNER REGION



Image © 2005 DigitalGlobe

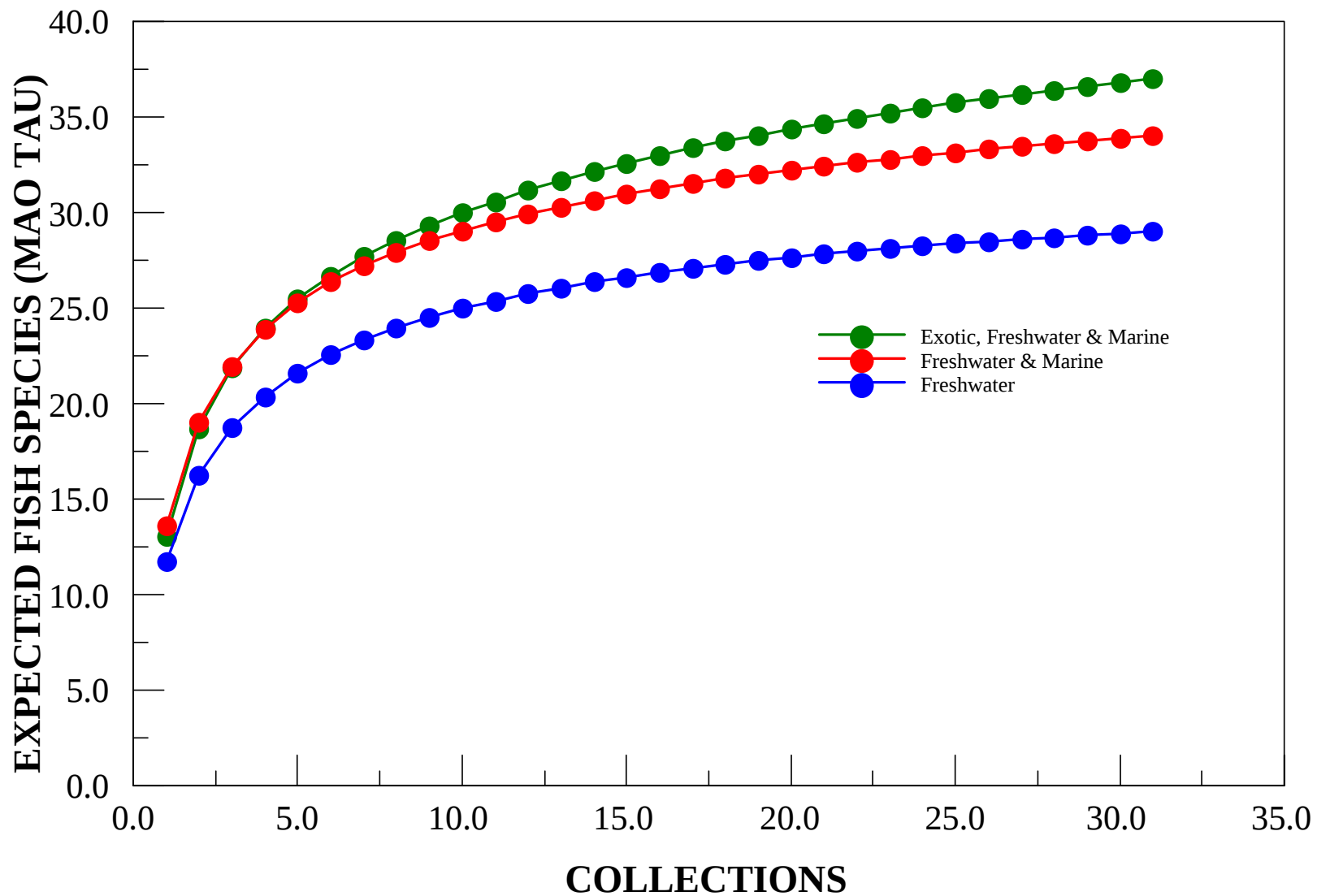
© 2005 Google

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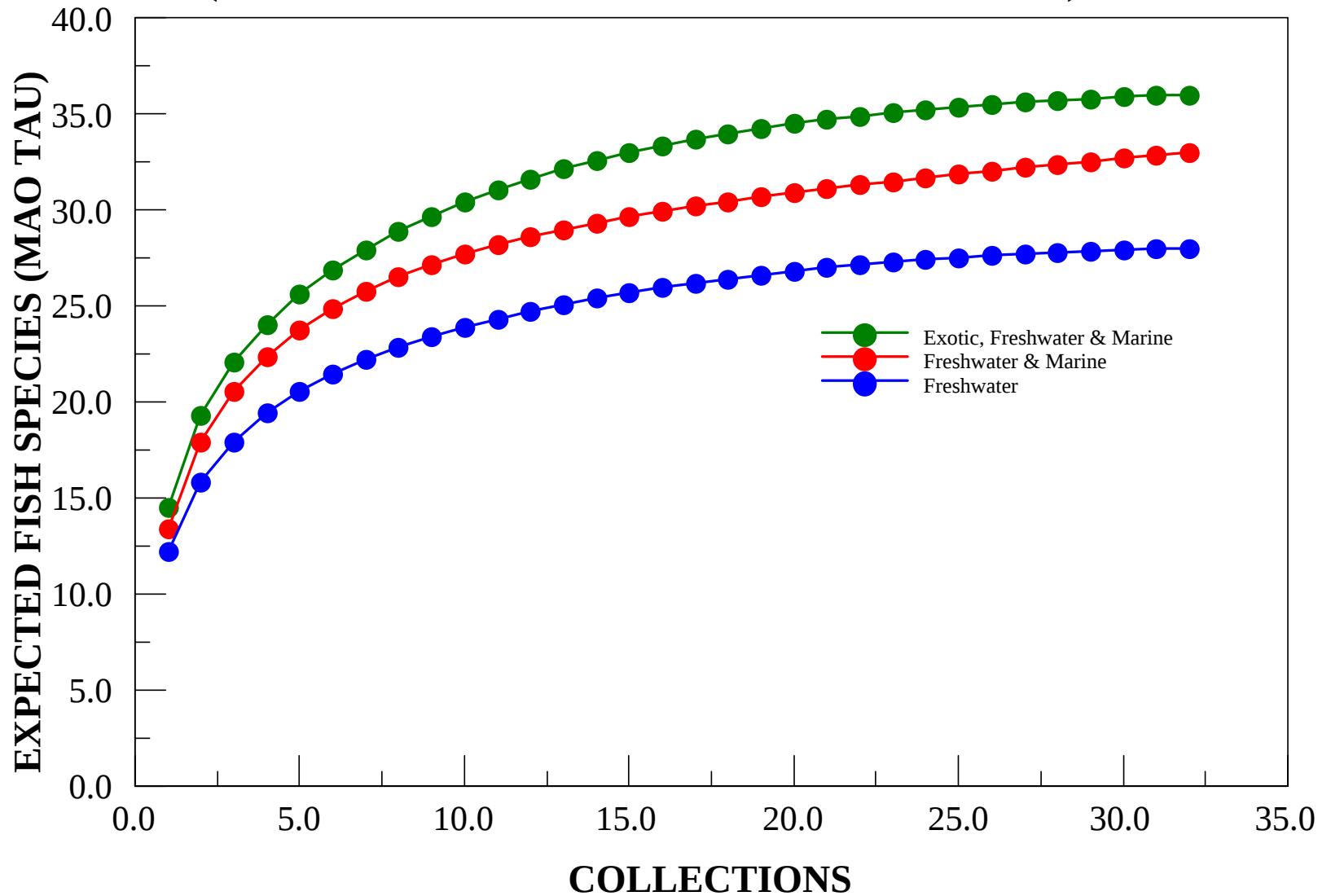
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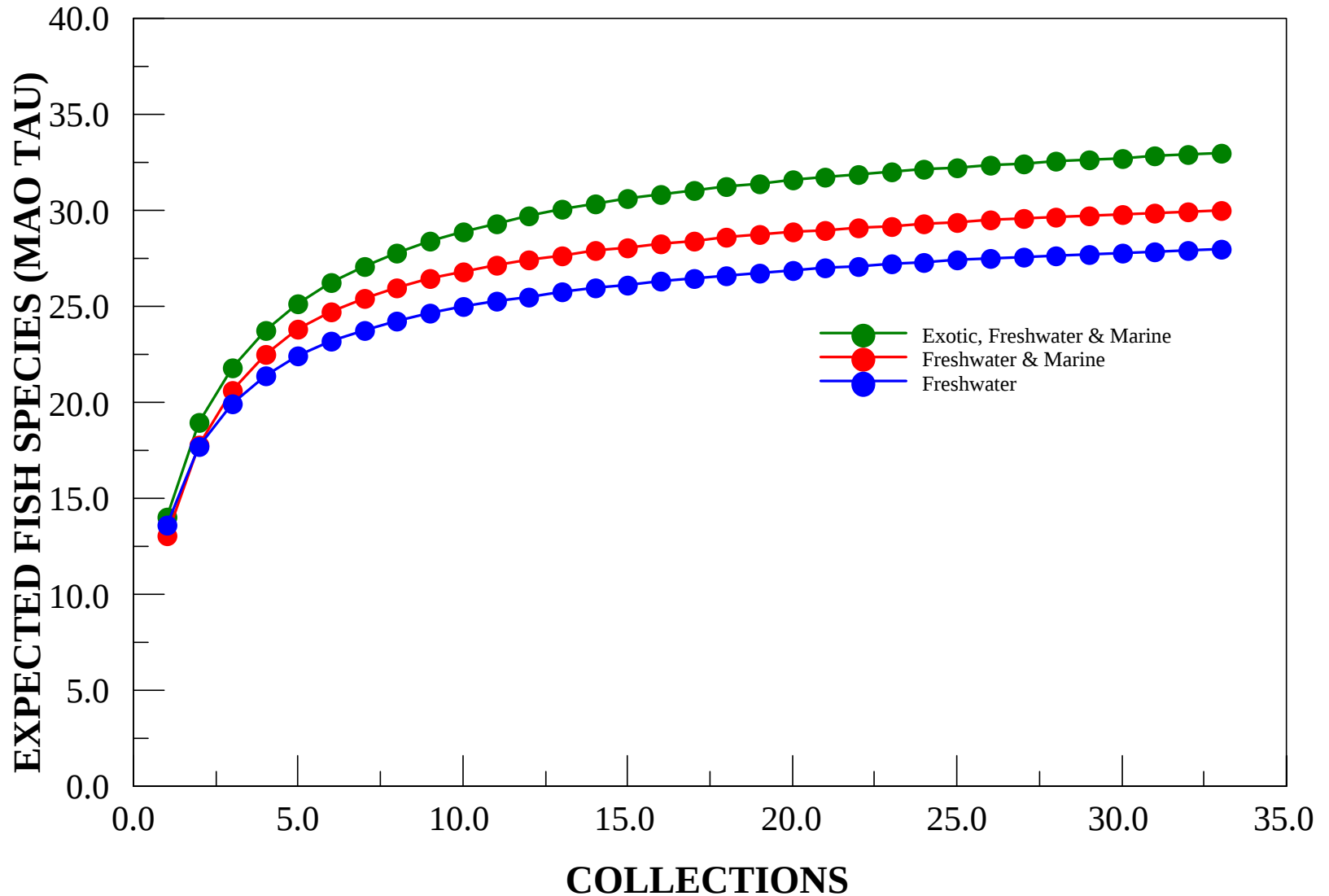
# FISH SPECIES FROM LOWER REGION OF THE PEACE RIVER (NOCATEE - GARDNER: FPL DATA, 1976).



**FISH SPECIES FROM LOWER REGION OF THE PEACE RIVER  
(NOCATEE - GARDNER: GFC DATA, 1983 - 1991).**



**FISH SPECIES FROM UPPER REGION OF THE PEACE RIVER  
(WACHULA, FT. MEADE & HOMELAND: GFC DATA, 1983-1991).**



HEAD →  
WATERS

HORSE CREEK



Image © 2005 DigitalGlobe  
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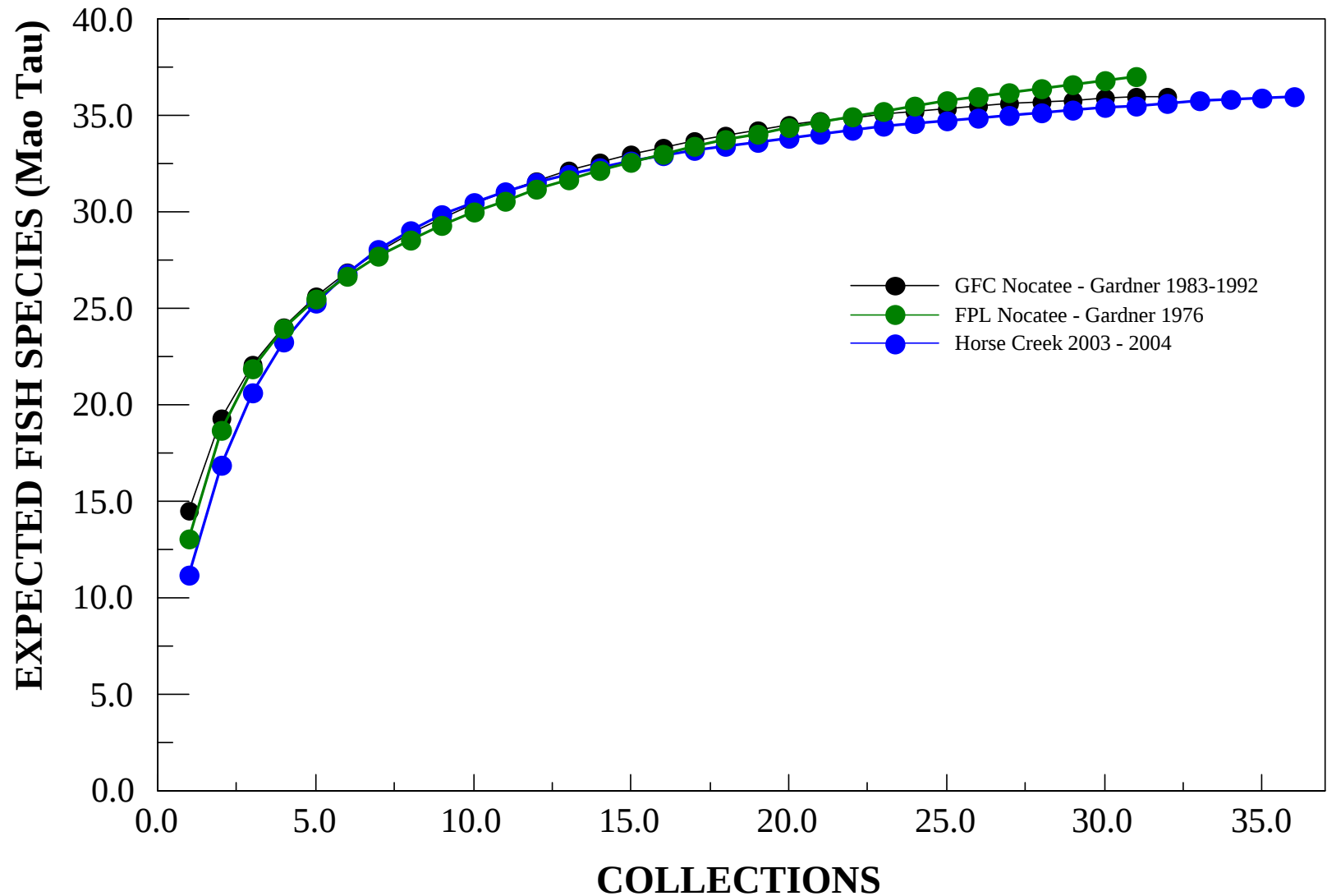
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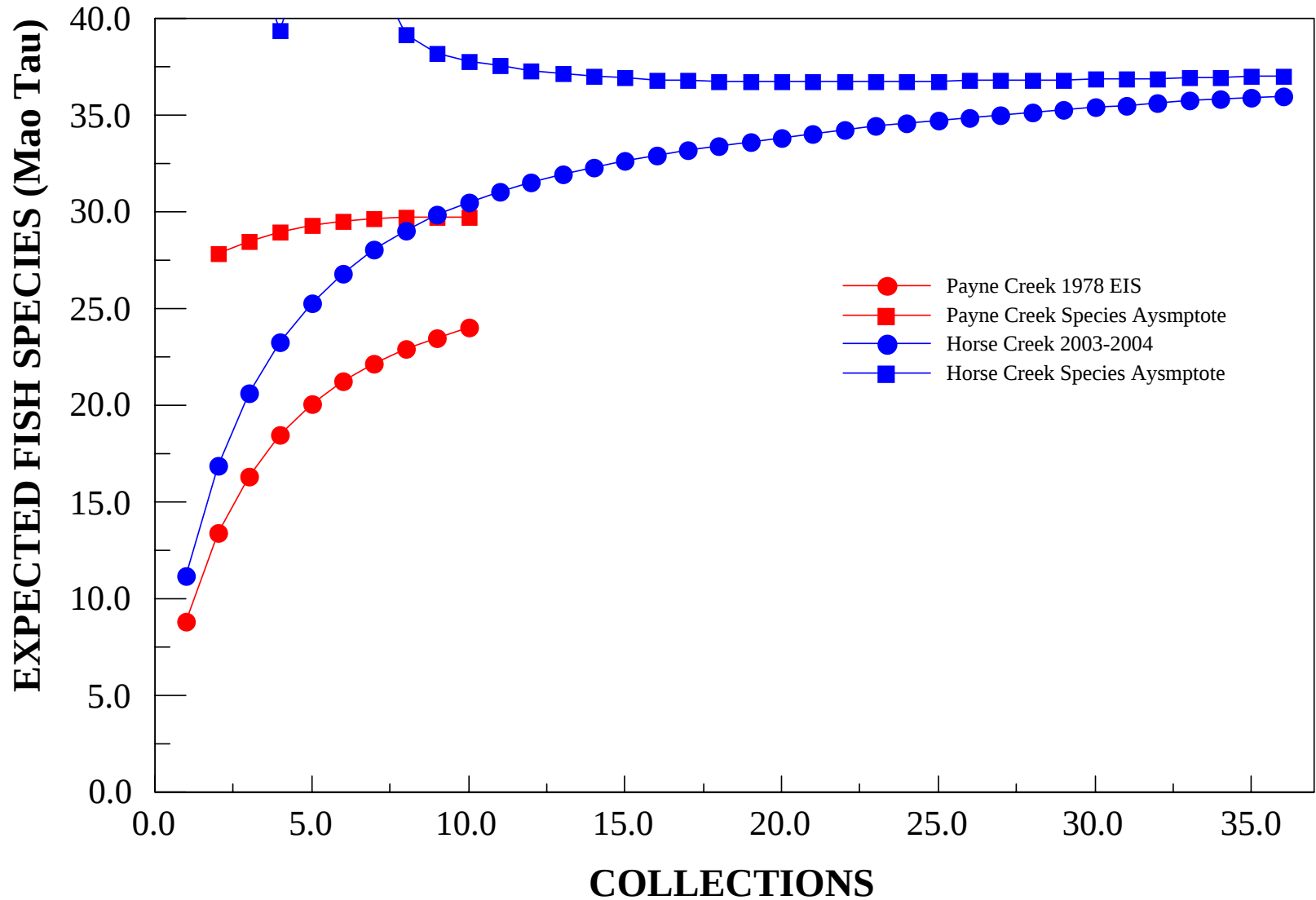
Streaming 100%

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**FISH SPECIES IN THE PEACE RIVER (GARDNER - NOCATEE)  
FOR 1976 & 1983 -1992 AND HORSE CREEK 2003-2004.**



## FISH SPECIES CURVE COMPARISONS FOR PAYNE CREEK 1978 & HORSE CREEK 2003-04 WITH SPECIES ASYMPTOTES



# TIDAL PEACE RIVER



Image © 2005 DigitalGlobe

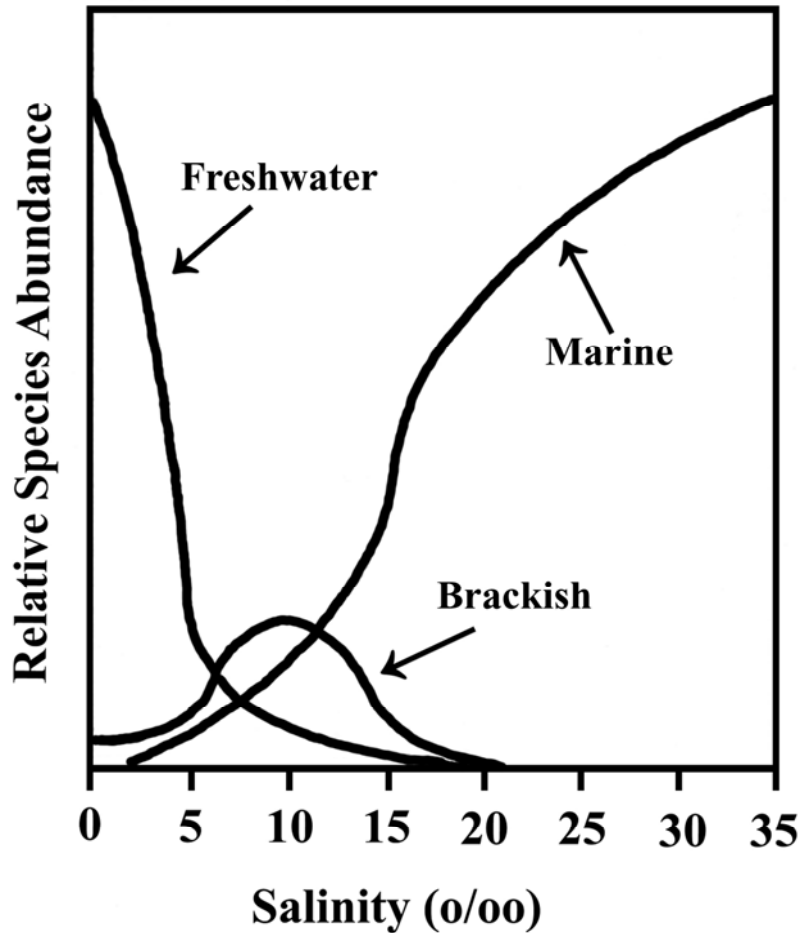
© 2005 Google

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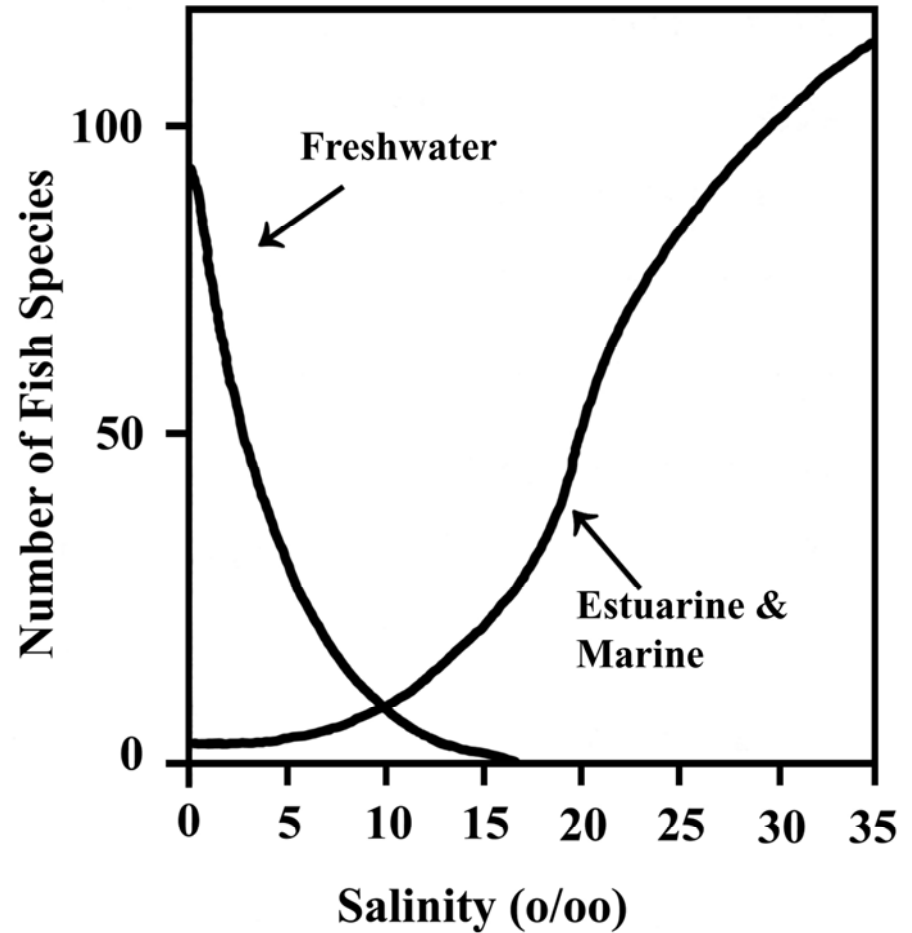
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(a)



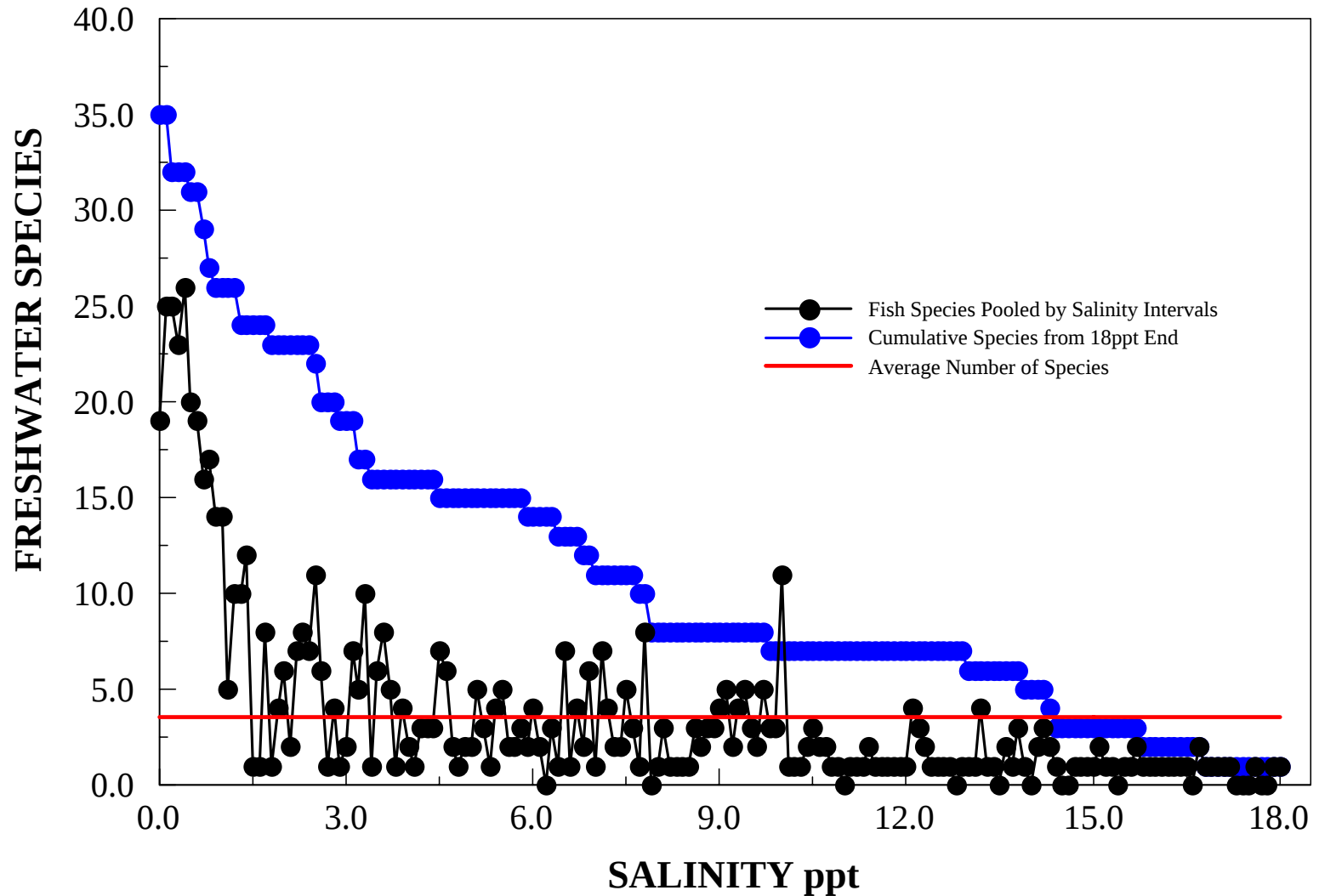
(b)



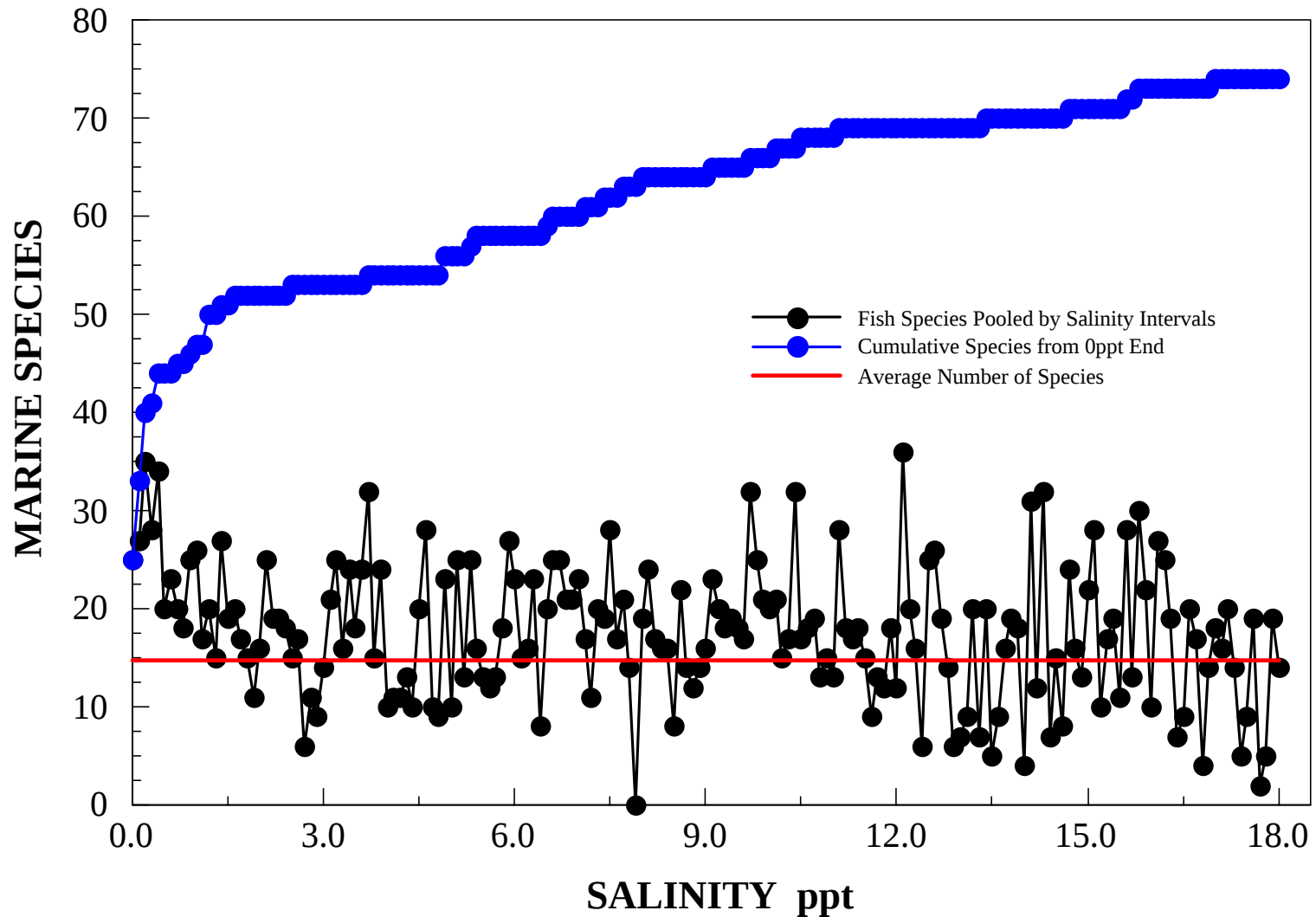
Hypothetical trends in (a) total species abundance (Remane, 1934 as redrawn by Deaton & Greenberg, 1986), and (b) number of species (Odum, 1988) with mean annual salinity along the estuarine gradient.

From Wagner (1999). Expression of the estuarine species minimum in littoral assemblages of the lower Chesapeake Bay tributaries. *Estuaries* 22(2a):304-312.

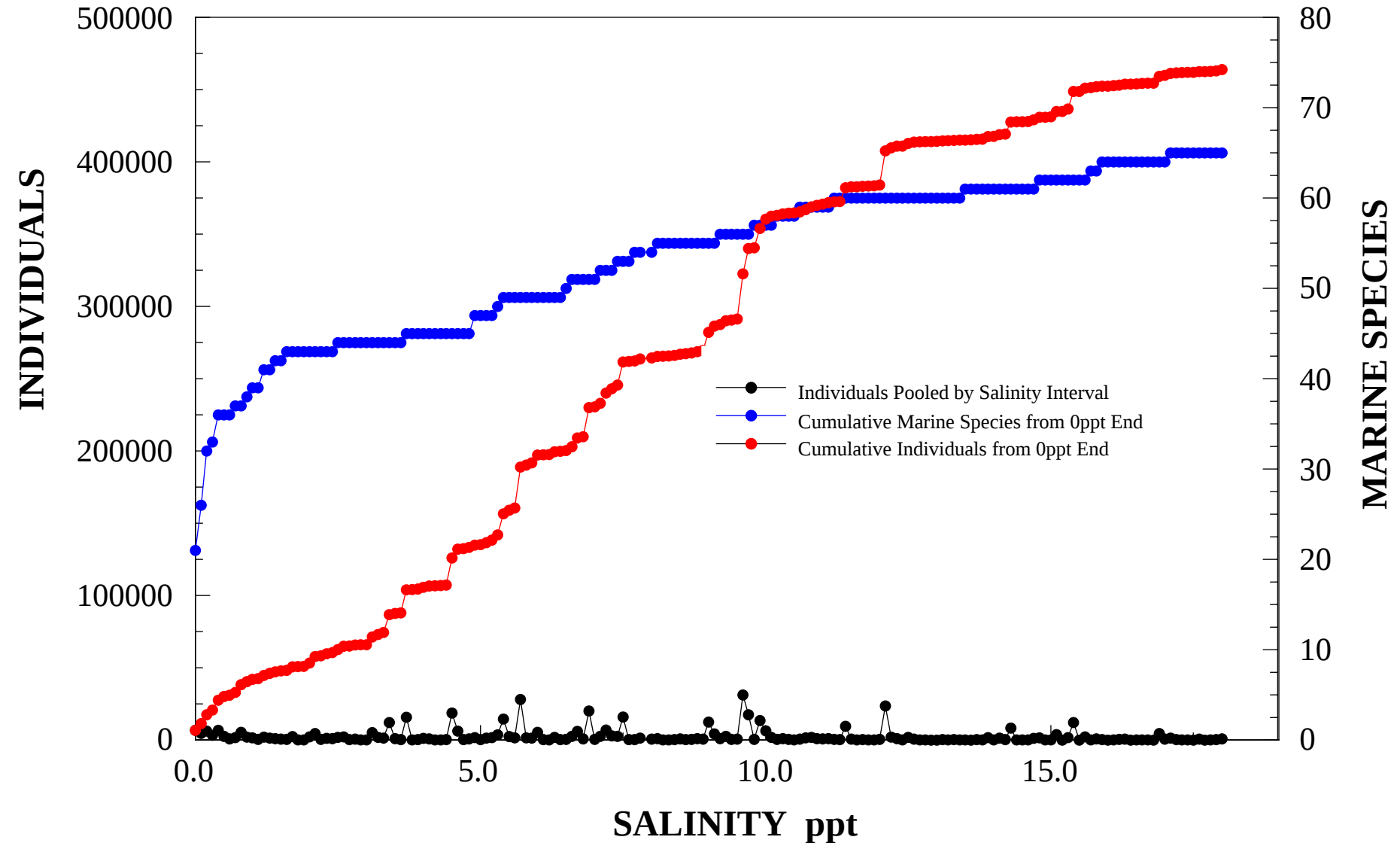
**FRESH WATER FISH SPECIES ALONG THE SALINITY GRADIENT  
FROM 18 TO 0 PPT IN THE TIDAL PEACE RIVER BY 0.1 PPT  
INCREMENTS (FIM DATA,1989-2003).**



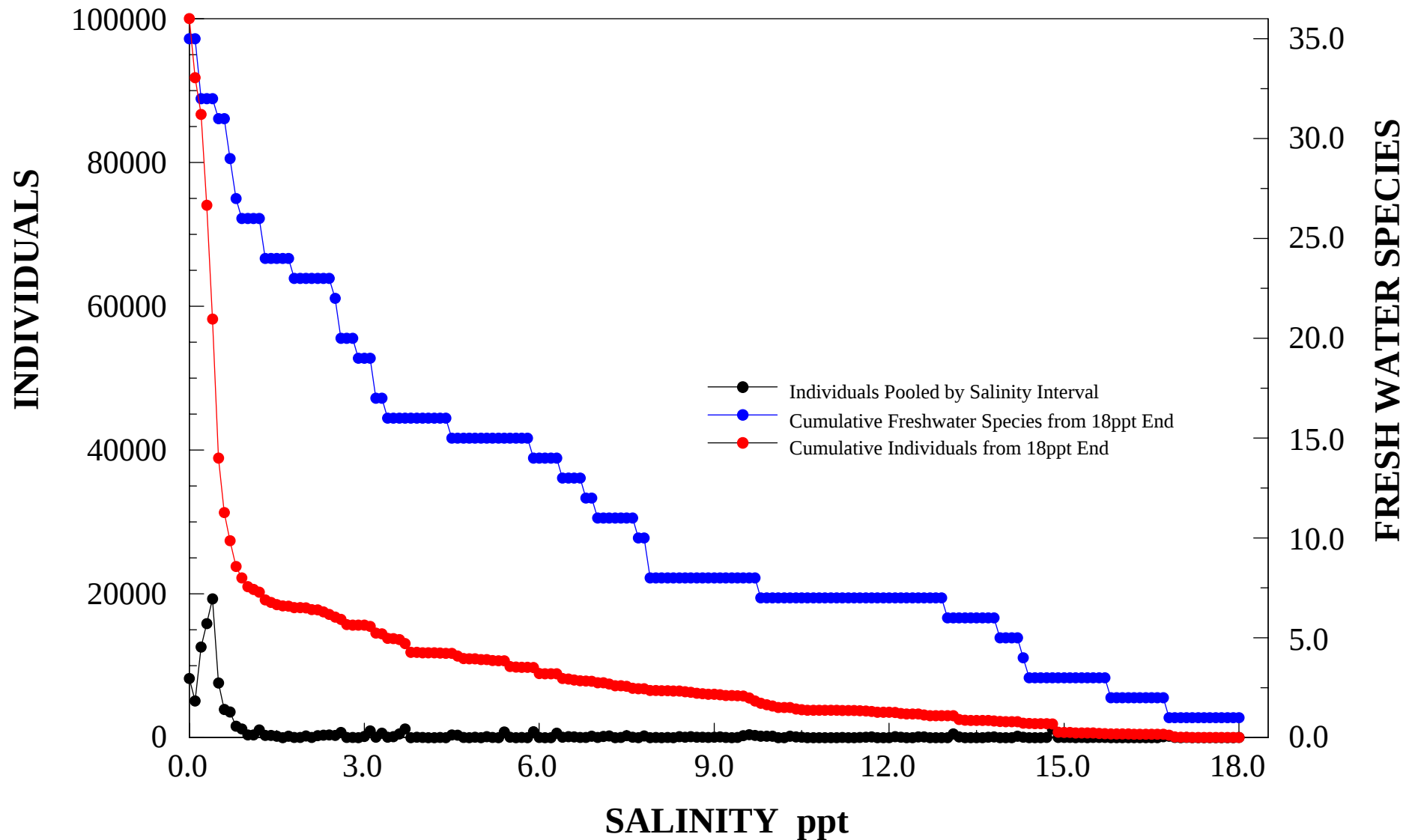
**ESTUARINE & MARINE FISH SPECIES ALONG THE SALINITY  
GRADIENT FROM 0 TO 18 PPT IN THE TIDAL PEACE RIVER  
BY 0.1 PPT INCREMENTS (FIM DATA,1989-2003).**



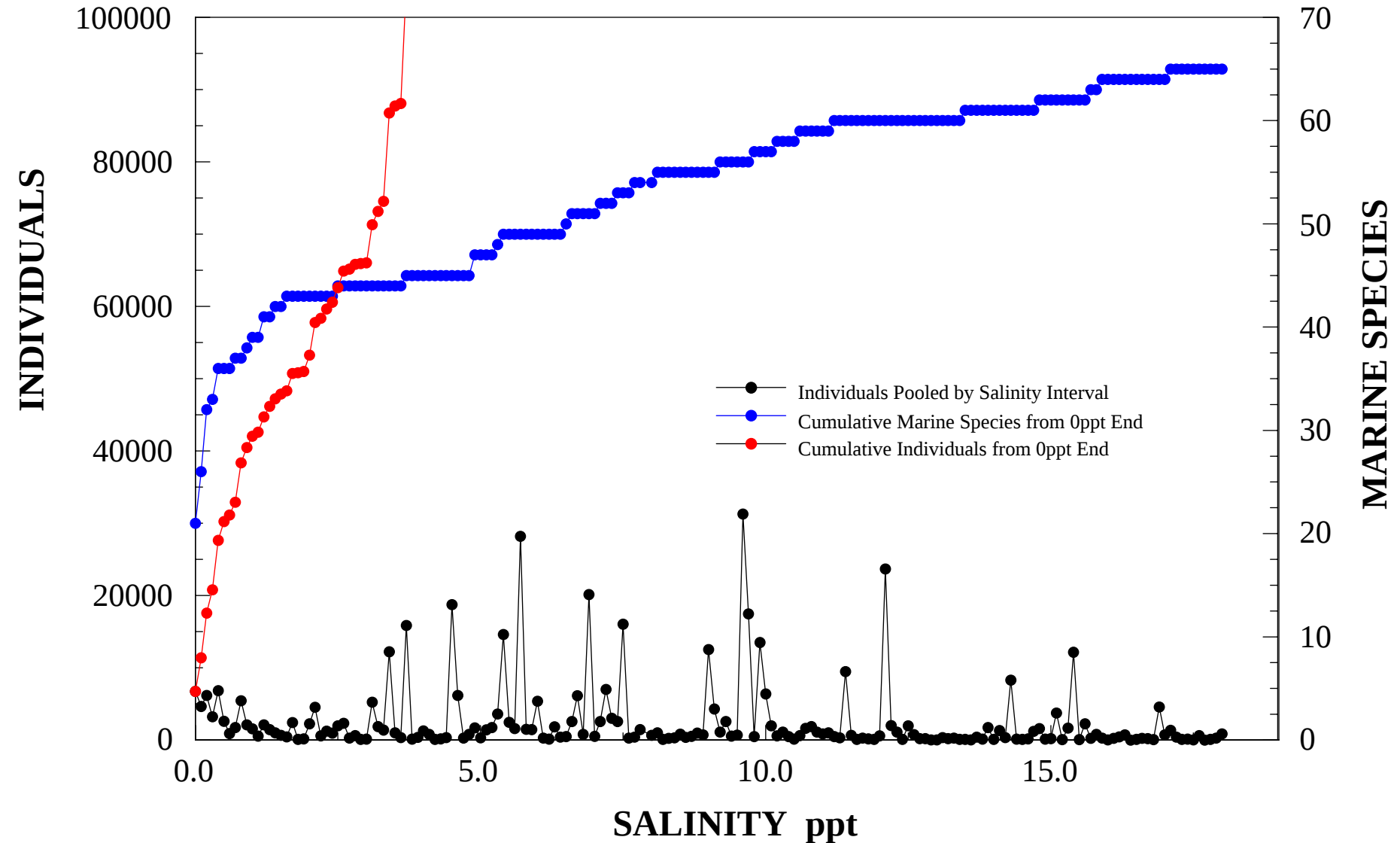
**MARINE FISH SPECIES AND INDIVIDUALS POOLED BY 0.1 SALINITY INTERVALS FOR THE TIDAL PEACE RIVER. FMRI FISHERIES INDEPENDENT MONITORING DATA, 1989-2003**



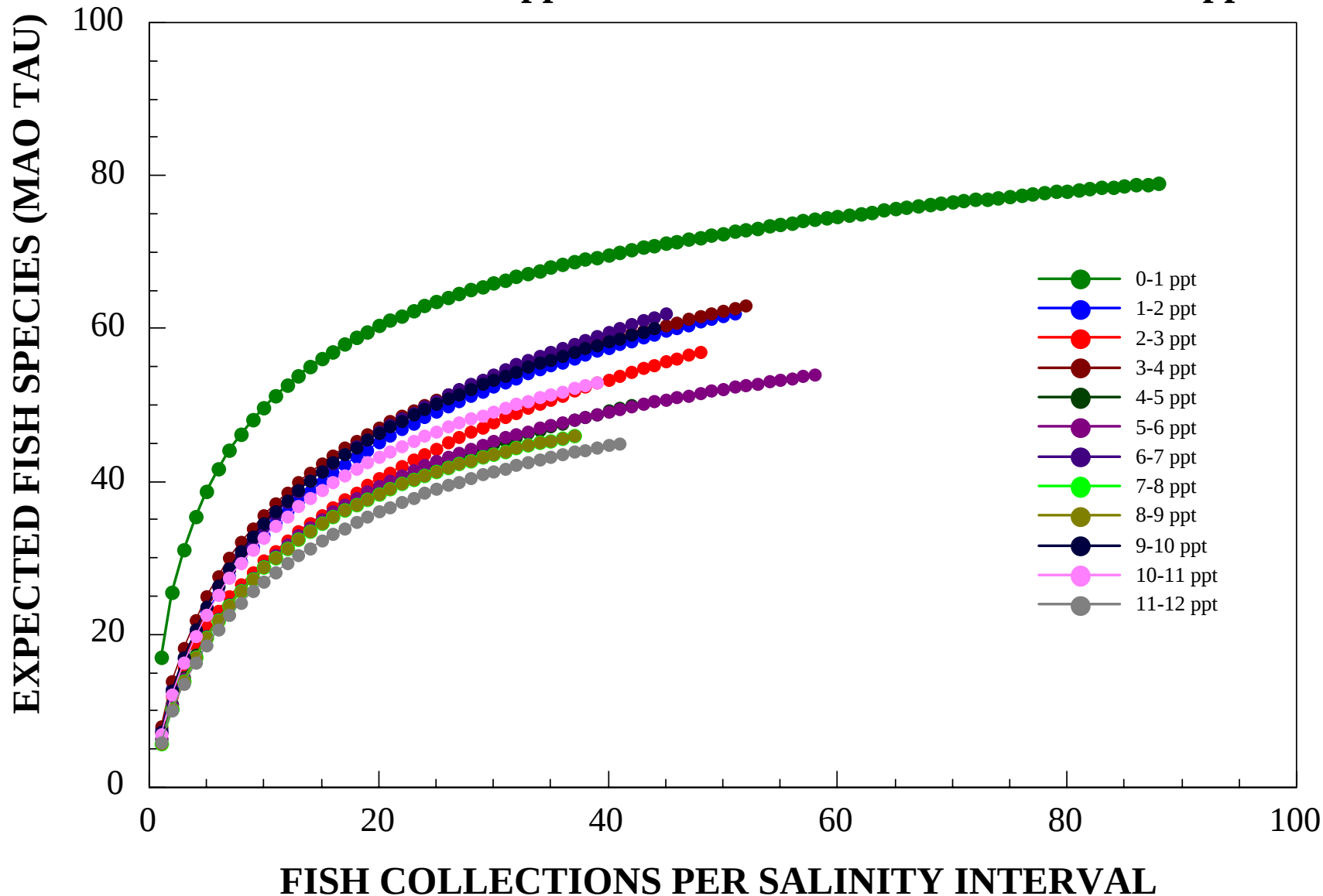
# **FRESHWATER FISH SPECIES AND INDIVIDUALS POOLED BY 0.1 SALINITY INTERVALS FOR THE TIDAL PEACE RIVER. FMRI FISHERIES INDEPENDENT MONITORING DATA, 1989-2003**



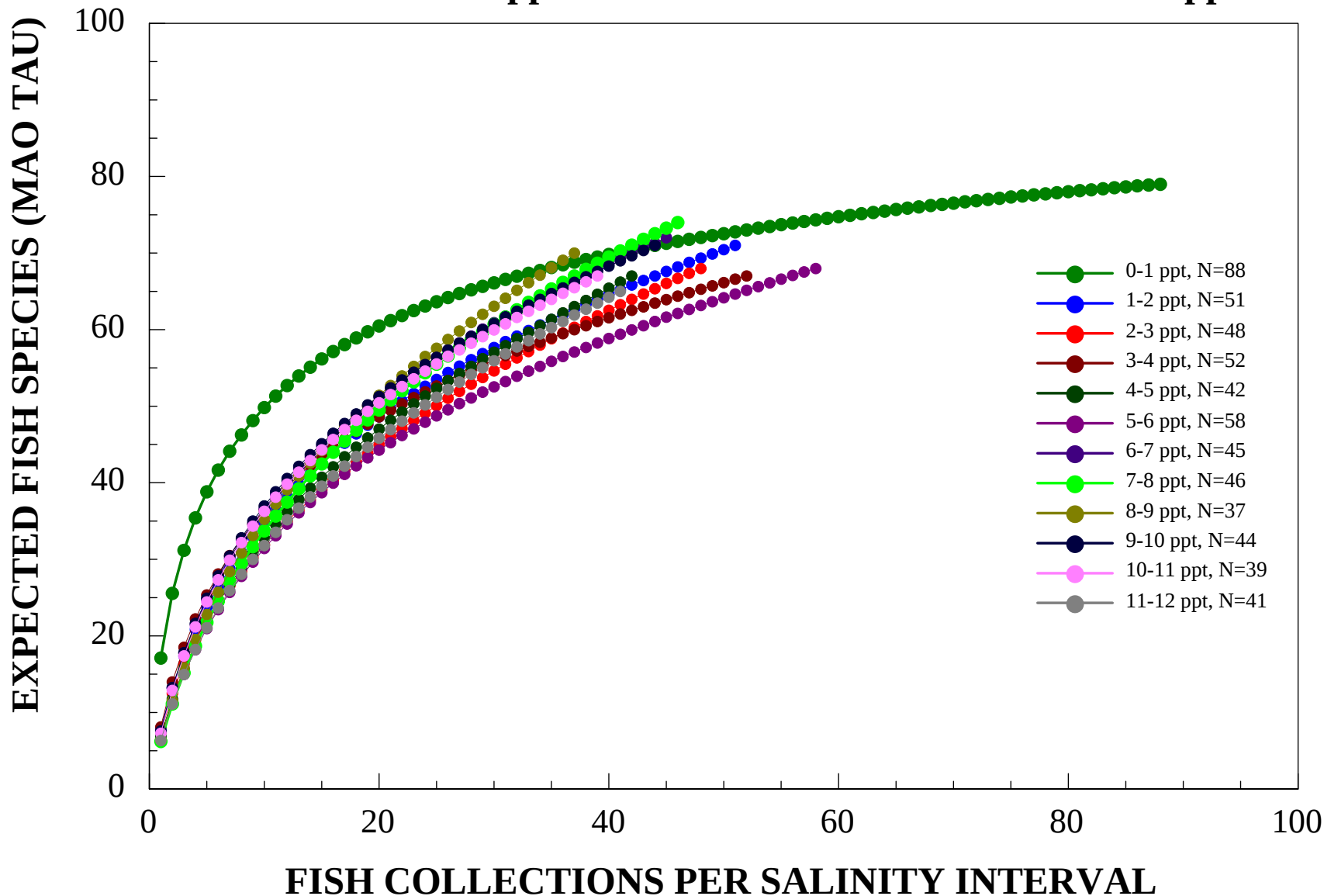
**MARINE FISH SPECIES AND INDIVIDUALS POOLED BY 0.1 SALINITY INTERVALS FOR THE TIDAL PEACE RIVER. FMRI FISHERIES INDEPENDENT MONITORING DATA, 1989-2003**



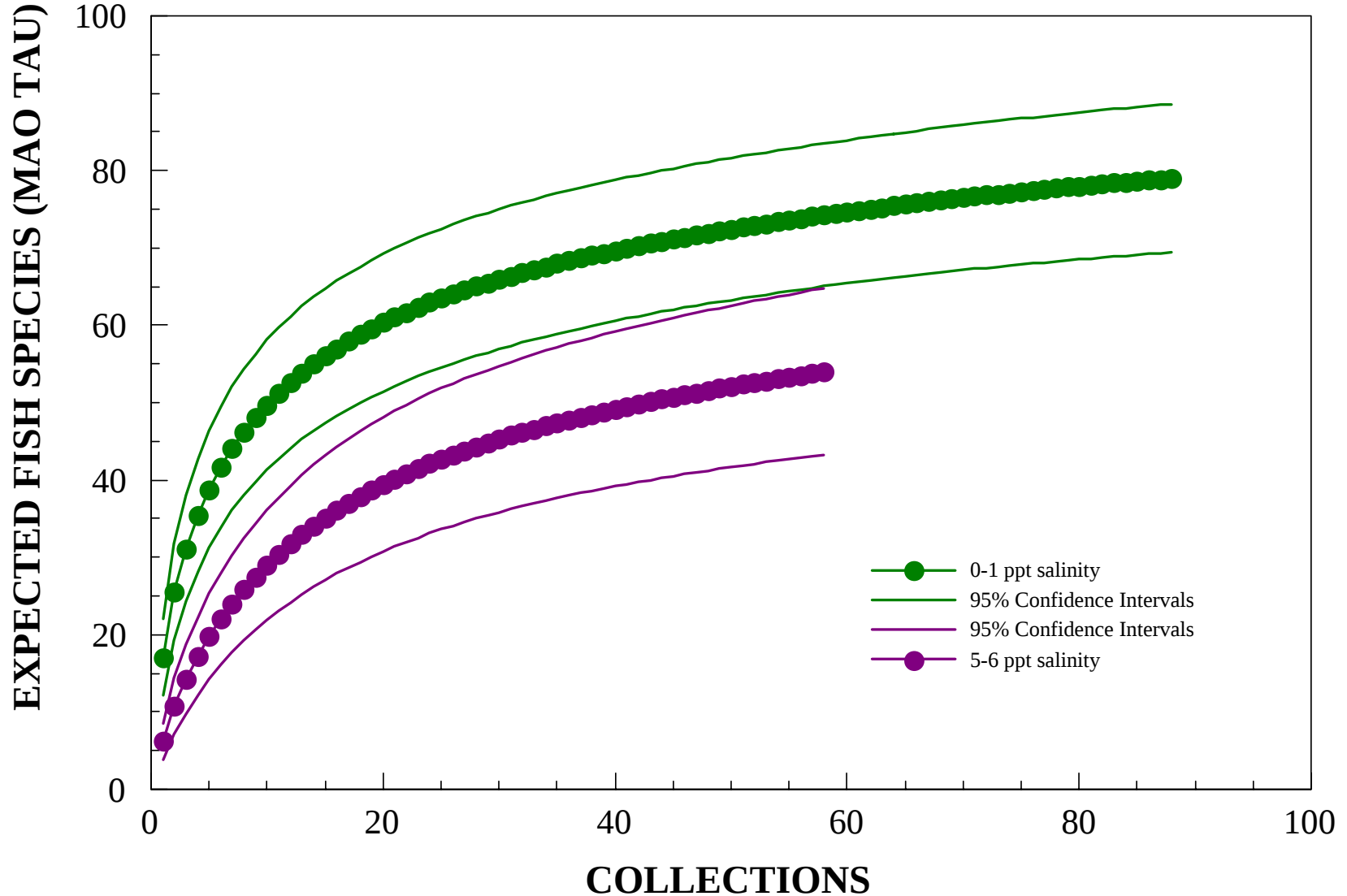
**FISH SPECIES IN THE TIDAL PEACE RIVER FIM PROGRAM,  
1998-2003 POOLED BY 1 ppt SALINITY INTERVAL FROM 0-12 ppt.**



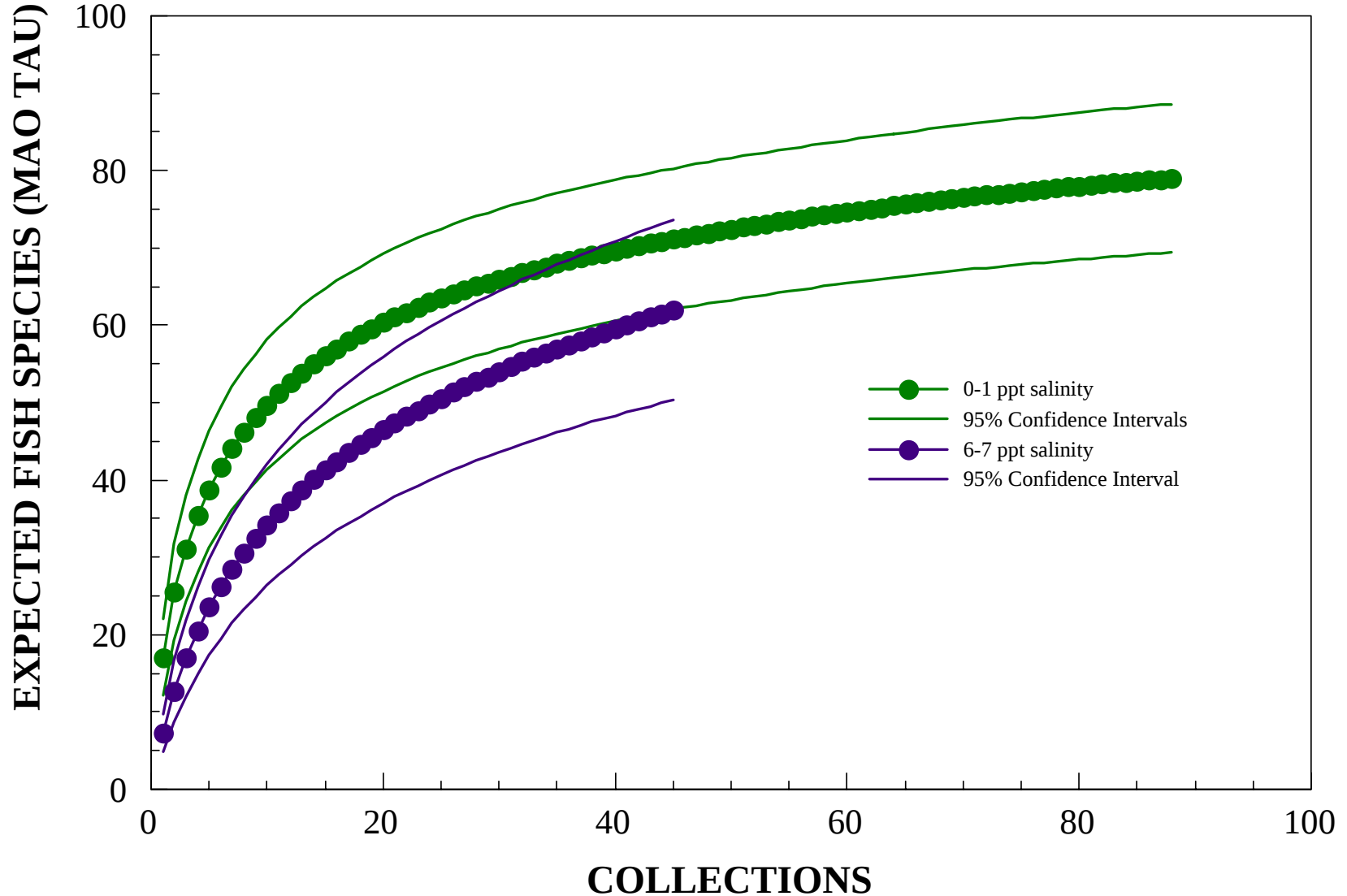
**ADJUSTED FISH SPECIES IN THE TIDAL PEACE RIVER FIM PROGRAM,  
1998-2003 POOLED BY 1 ppt SALINITY INTERVAL FROM 0-12 ppt.**



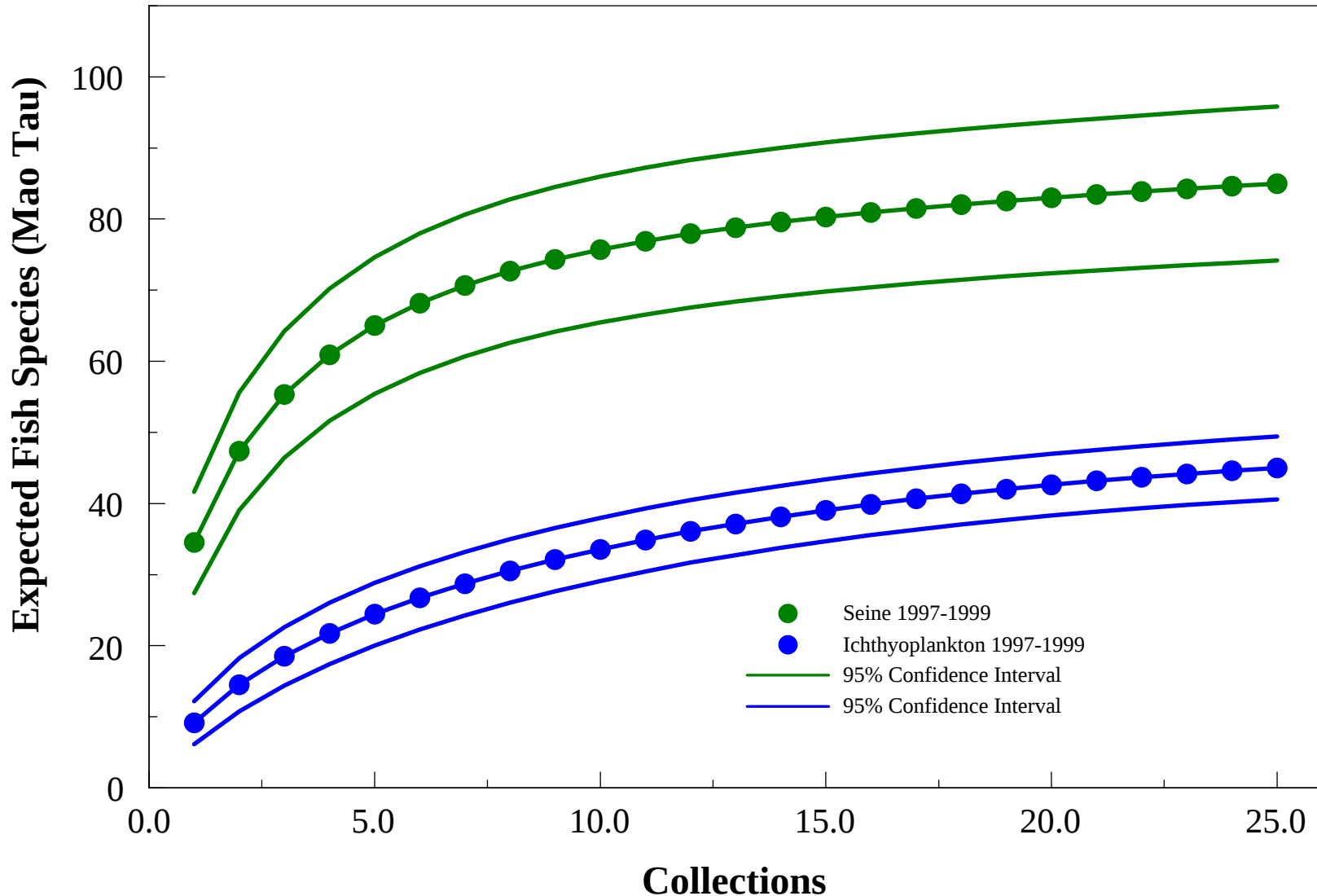
# FISH SPECIES FOR THE 0-1 ppt & 5-6 ppt SALINITY INTERVALS IN THE TIDAL PEACE RIVER, FIM PROGRAM 1989-2003.



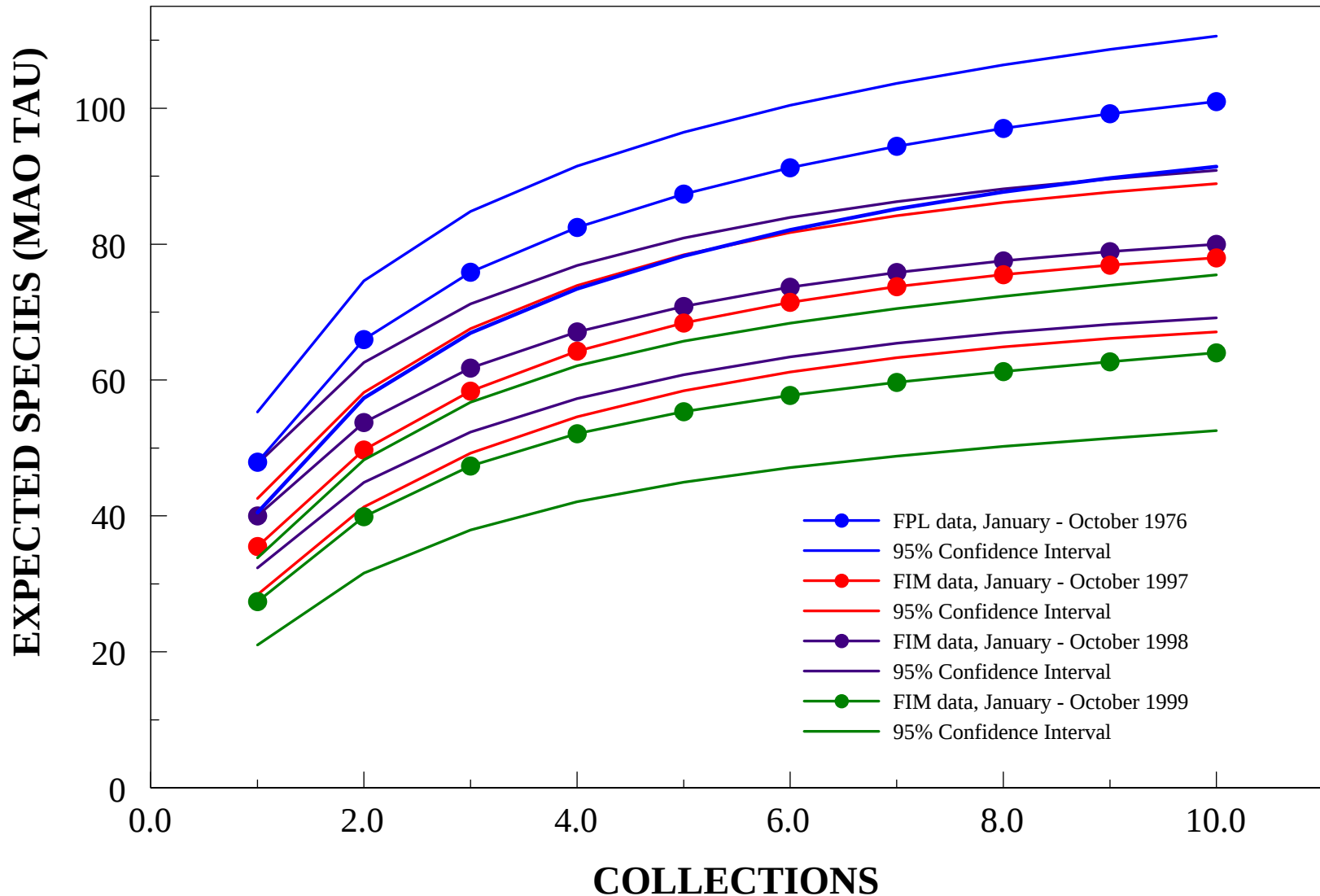
**FISH SPECIES FOR THE 0-1 ppt & 6-7 ppt SALINITY INTERVALS  
IN THE TIDAL PEACE RIVER, FIM PROGRAM 1989-2003.**



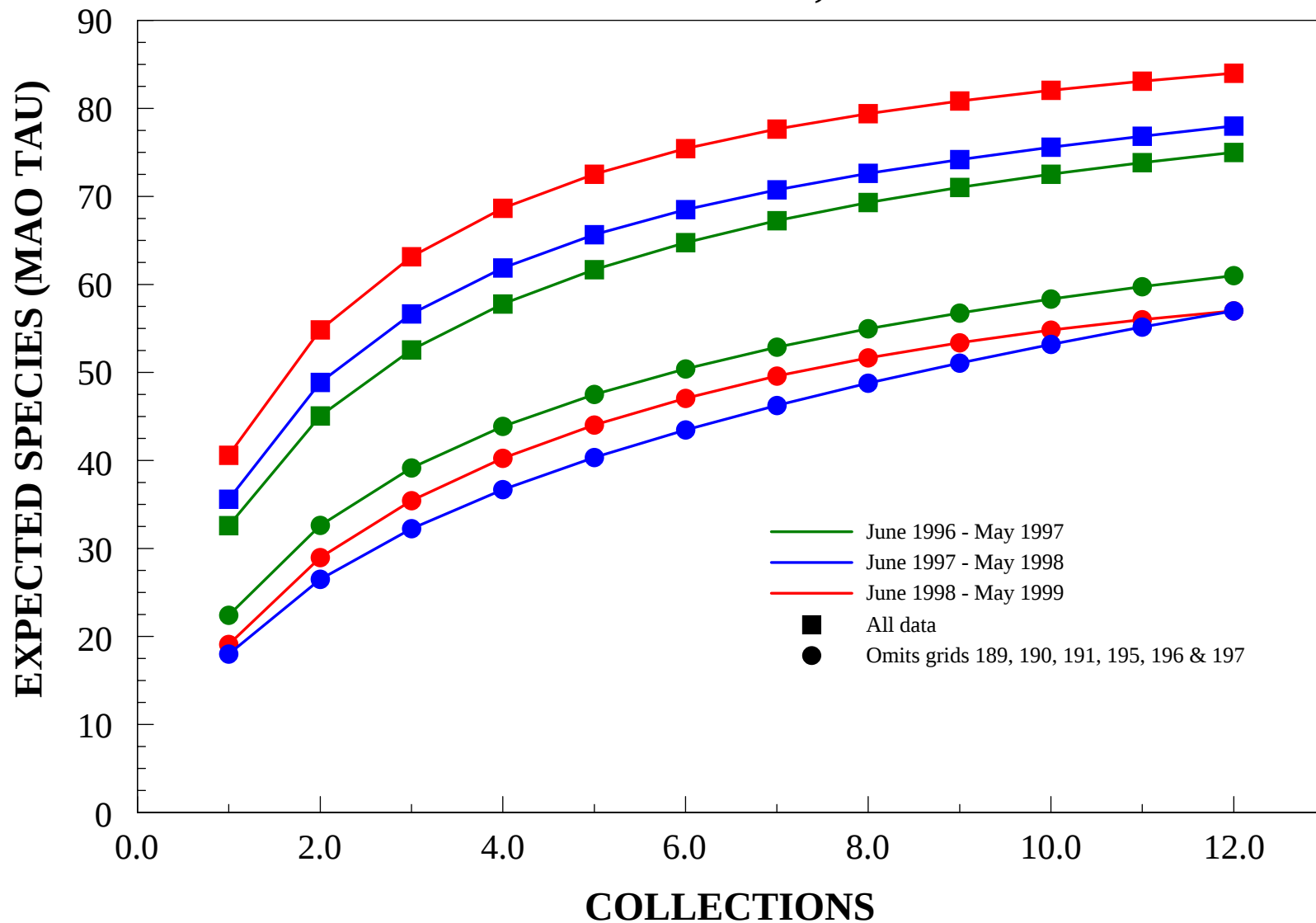
**FISH SPECIES COLLECTED IN THE TIDAL PEACE RIVER  
ABOVE THE U. S. 41 BRIDGES. ZOOPLANKTON TOWS AT  
NIGHT AND FOR FIM SEINE DATA, MAY 1997-MAY1999**



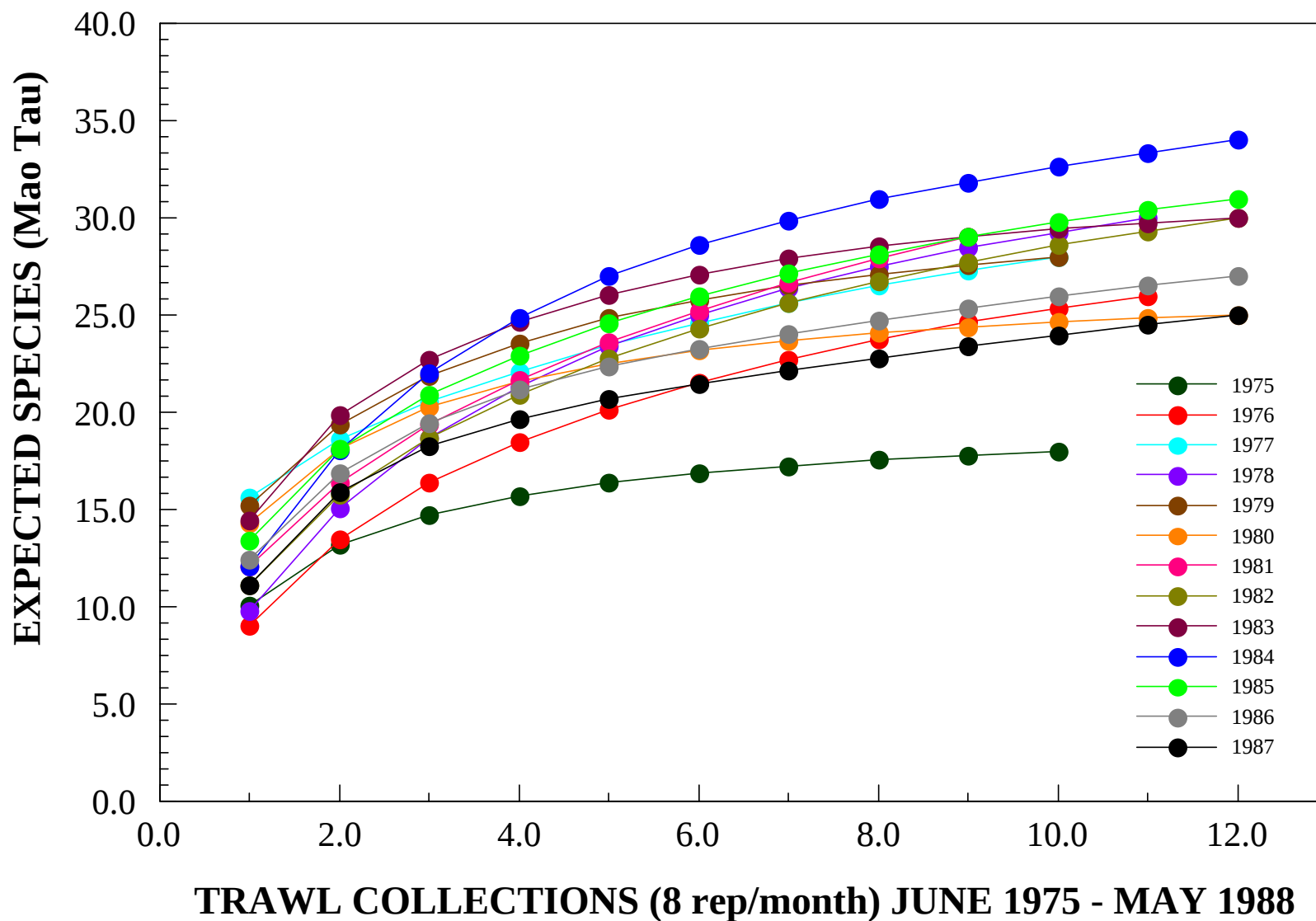
# COMPARISONS OF FISH SPECIES ACUMMULATION CURVES FOR THE TIDAL PEACE RIVER. 1976 FPL DATA, 1997, 1998 AND 1999 FIM DATA.



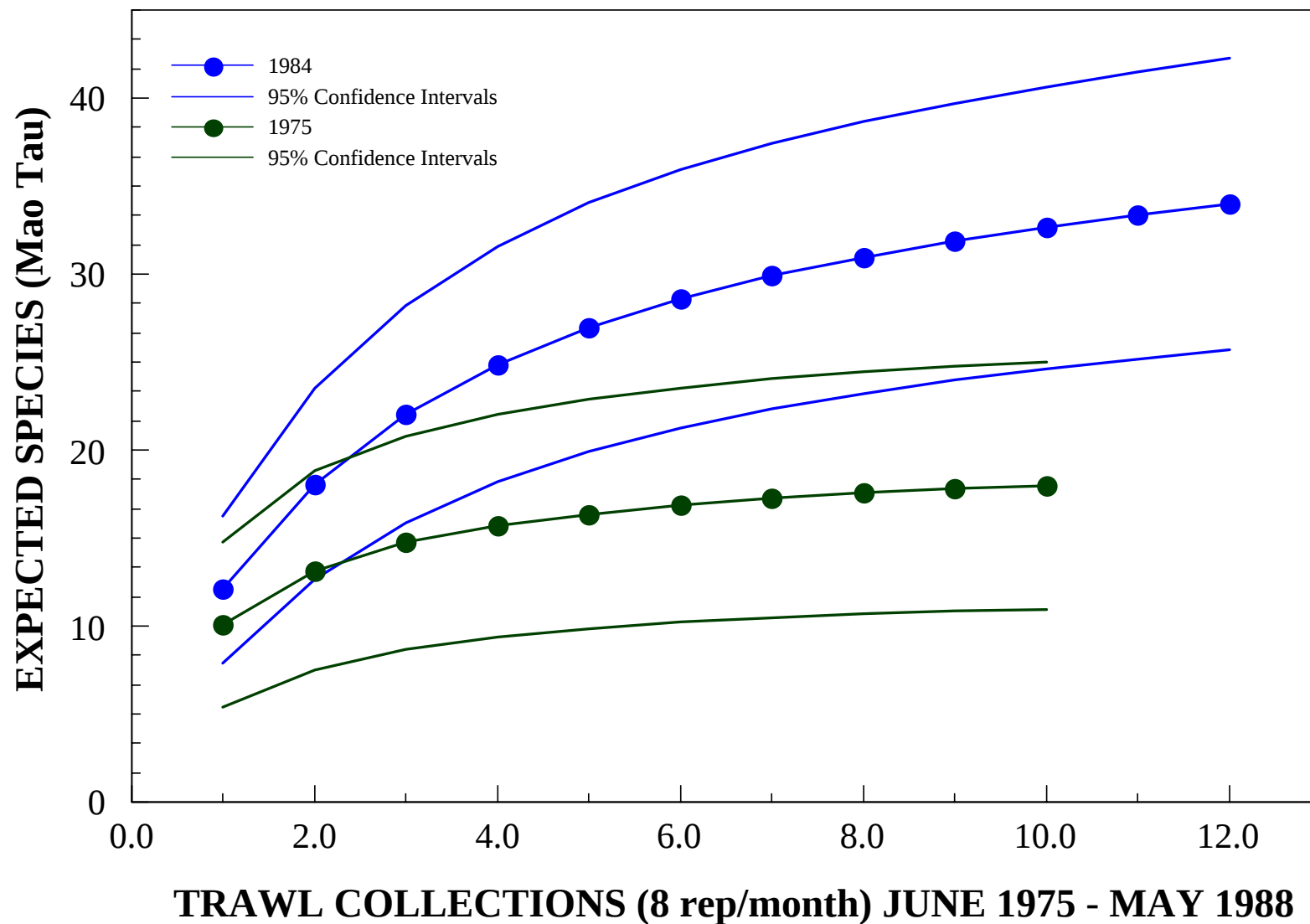
# ANNUAL FISH SPECIES ACUMMULATION CURVES FOR THE TIDAL PEACE RIVER FROM FIM DATA, POOLED MONTHLY SEINE & TRAWLS, 1996 -1999



# FISH SPECIES NEAR MARKER 1 IN CHARLOTTE HARBOR. 100 RANDOMIZATIONS WITH REPLACEMENT

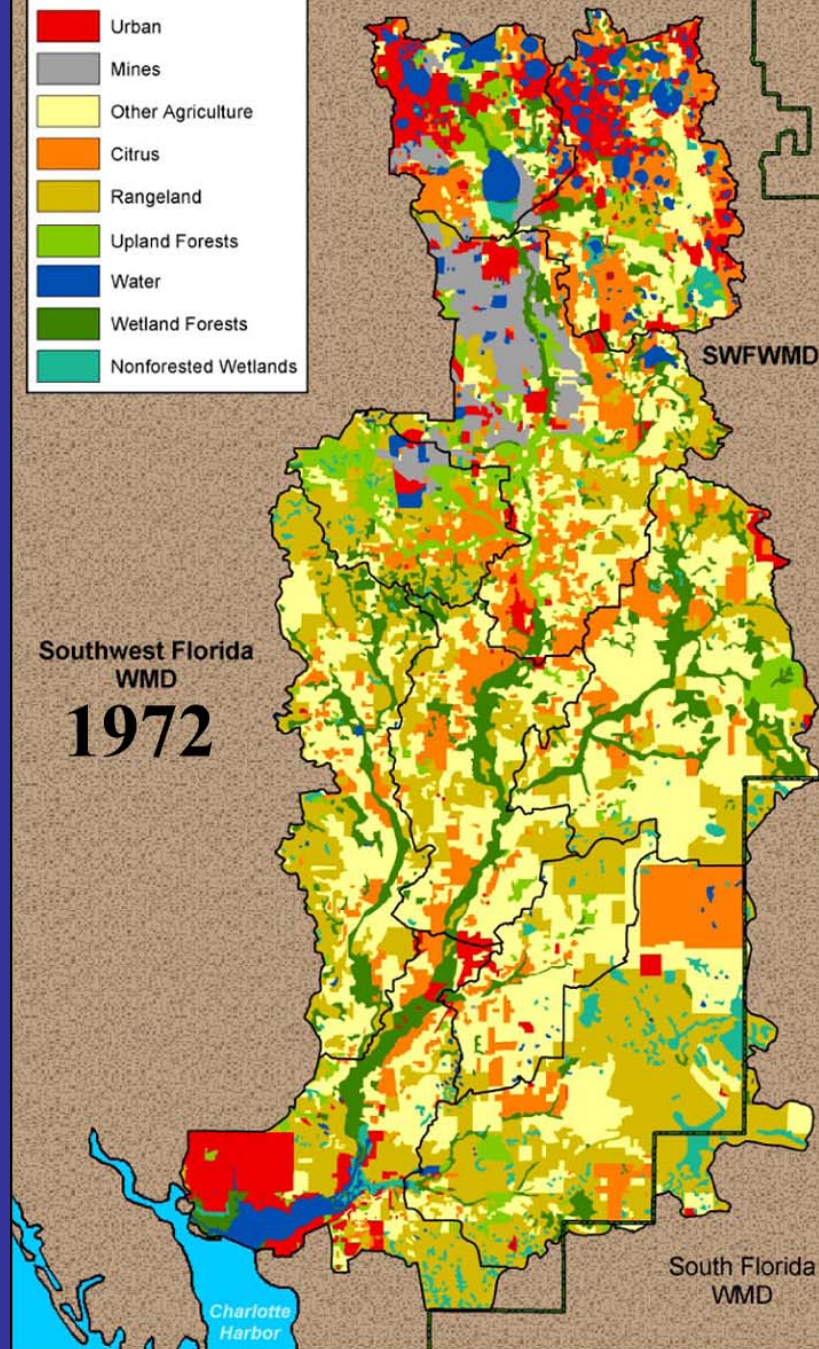


# FISH SPECIES NEAR MARKER 1 IN CHARLOTTE HARBOR. 100 RANDOMIZATIONS WITH REPLACEMENT



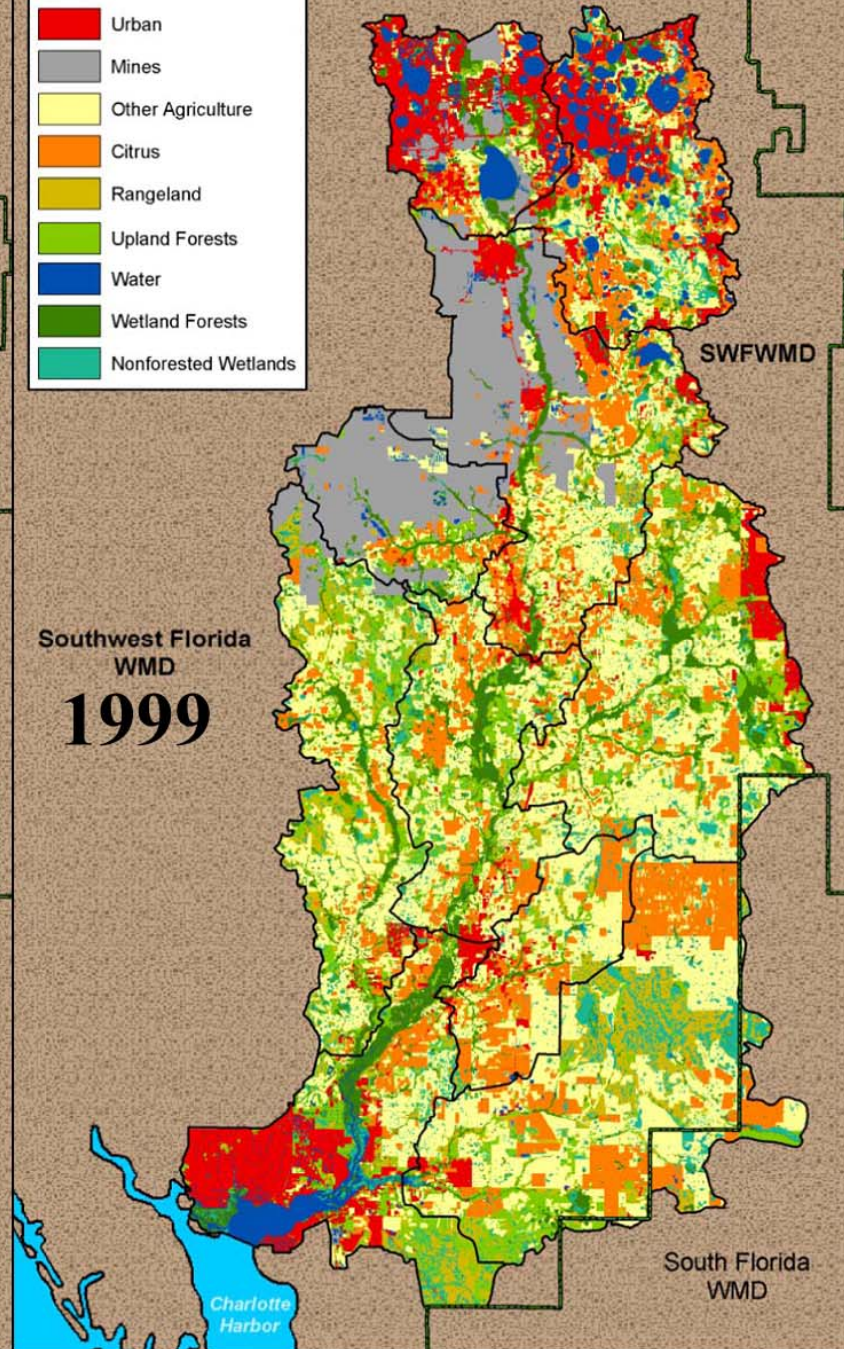
### Legend

- Urban
- Mines
- Other Agriculture
- Citrus
- Rangeland
- Upland Forests
- Water
- Wetland Forests
- Nonforested Wetlands



### Legend

- Urban
- Mines
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- Citrus
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- Water
- Wetland Forests
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# Watershed Changes Influencing Fish Fauna

- **PHOSPHATE MINING IN THE RIVER 1888-1909**
- **FIVE MAJOR RELEASES OF CLAY WASTE 1960-1971**
- **UPPER RIVER SEGMENT – GENERALLY FROM PAYNE CREEK UPSTREAM**
  - LAKE HANCOCK EUTROPHICATION BEGINNING IN THE 1950s
  - KISSENGEN SPRING'S CONTINUOUS FLOW CEASES IN 1950s
  - KARST REGION CONTINUOUS GROUND WATER DISCHARGE LOST IN 1950s
  - LOSS OF SURFICIAL AQUIFER DISCHARGE TO BASE FLOW BETWEEN BARTOW & FORT MEADE

# Watershed Changes Influencing Fish Populations

- **DECREASED FLOW AT BARTOW – INFLUENCE OF CLIMATE OSCILLATION & HUMAN ALTERATION(?)**
  - ~31% (1940-1960) IN MAY AT ARCADIA
  - ~12% (1985-2000) IN MAY AT ARCADIA
- **ALTERATION & LOSS OF FIRST & SECOND ORDER STREAMS**
- **GENERAL ALTERATIONS**
  - TRUNKS & WOODY DEBRIS REMOVED FOR NAVIGATION ~ 1930
  - POINT SOURCE MANAGEMENT BEGINNING ~1981
  - MAJOR LOSS OF RIVERINE TAPE GRASS ~ 1970s (?)
  - EXOTIC FAUNA & FLORA CAME WITH HUMAN ACTIVITIES
  - WITHDRAWAL OF GROUNDWATER FOR IRRIGATION WITH INCREASING CONDUCTIVITY IN TRIBUTARIES

# Watershed Changes Influencing Fish Populations

- **TIDAL PEACE RIVER**
  - LOSS OF MANGROVE SHORELINES – I-75 TO MOUTH OF RIVER
  - DRINKING WATER SOURCES & DAM ON SHELL CREEK
  - SEDIMENT CHANGES

# Fish Species & Habitats

- **PEACE RIVER NATIVE FISH FAUNA**
  - 43 to 45 FRESH WATER SPECIES KNOWN HISTORICALLY
  - ~97 ESTUARINE/MARINE SPECIES IN TIDAL RIVER
- **RIVER SEGMENTS**
  - **KARST REGION OF PEACE RIVER**
    - MORE SPECIES PRE-1970s THAN IN RECENT YEARS
    - IMPACTED IN MODERN STATE – PREVIOUSLY HAD LOWER COLOR, LOWER NUTRIENTS, HIGHER FLOW AND ABUNDANT TAPE GRASS
  - **LOWER PEACE RIVER WITH STABLE FISH FAUNA**
  - **TIDAL PEACE WITH FEWER SPECIES THAN IN 1976**

# Fish Species & Habitats

- **ROLE OF TRIBUTARIES**

- MORE HIGH QUALITY HABITATS DURING WETTER DECADES
- NURSERY FOR YOUNG
- MAINTENANCE OF FLOW TO HIGHER ORDER STREAMS
- SOURCE OF FISH TO MAIN RIVER STEM AFTER DISTURBANCES

- **LOSS OF FIRST & SECOND ORDER STREAMS**

- GEOGRAPHIC DISTRIBUTION
- INFLUENCE ON FISH DIVERSITY
- EFFECTS OF WETLAND MITIGATION
- FORESTED STREAM RE-CREATION & RESTORATION

# Summary

- Large gaps exist in time and space for fish collections. Useable data exist for entire Peace River, Horse, Payne and Whidden Creeks.
- Overall Peace River watershed fish fauna data show a decline in species based on a habitat index.
- The Upper Peace River had more species present in the past than occur in recent data sets.
- Data show decline in species number for Payne Creek watershed, indirectly for Whidden Creek watershed.

# Summary

- Horse Creek and the Lower Peace River fish fauna have been stable since 1976.
- Some estuarine/marine fishes use most of the Peace River, with more species found in the Lower Peace River. Some tributaries were used by estuarine/marine fishes.
- Tidal Peace River fish fauna data show a decline in species number between 1976 and recent data.
- At least six exotic fishes are established and reproducing in the Peace River watershed.