Spatial application of a habitat suitability index model for lake sturgeon

Tim Haxton
Kemptville, ON

Ontario
Ministry of Natural Resources
Ministère des Richesses naturelles

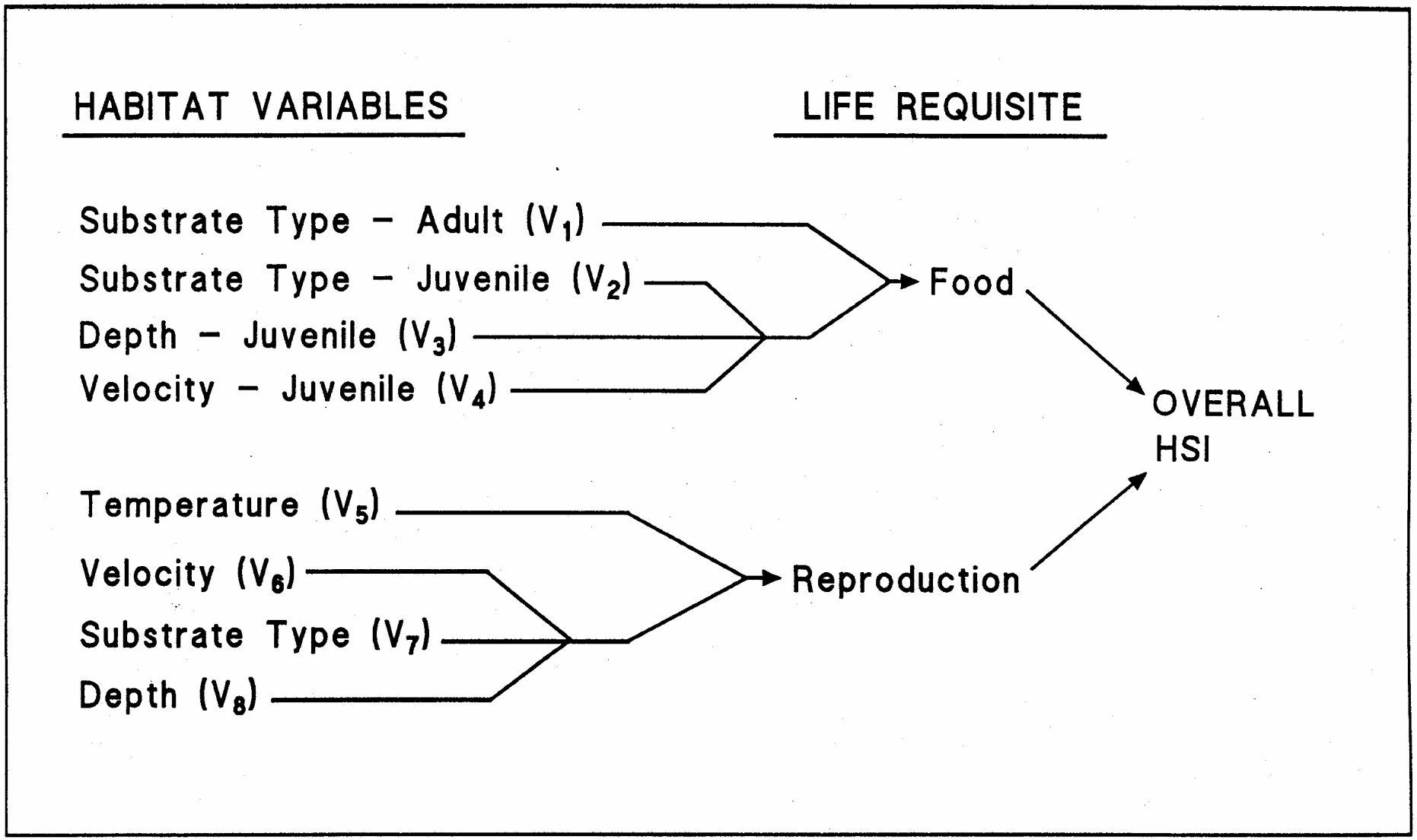
HYDROELECTRIC

Development of a Habitat Suitability Index Model for Lake Sturgeon (*Acipenser fulvescens*)

Report No. H-07015.01--0012
January, 1998

Environmental Support Department

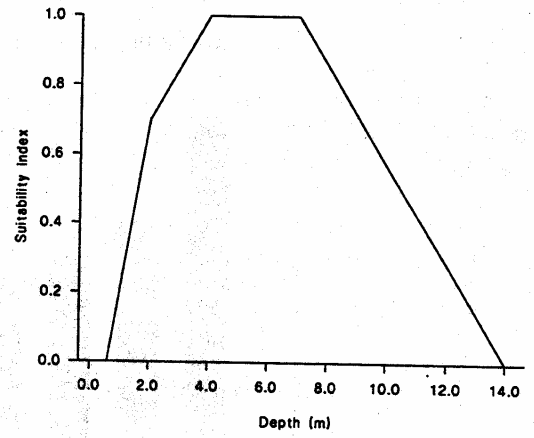
Threader, R. R.J. Pope and P.R.H. Schaap. 1998. Development of a habitat suitability index model for lake sturgeon. Ontario Hydro, Environmental Support Department. Report H-07015.01--0012.


HABITAT VARIABLES
LIFE REQUISITE
Substrate Type – Adult (V_1)
Substrate Type – Juvenile (V_2)
Depth – Juvenile (V_3)
Velocity – Juvenile (V_4)
Food
OVERALL HSI
Temperature (V_5)
Velocity (V_6)
Substrate Type (V_7)
Depth (V_8)
Reproduction

SUITABILITY INDEX GRAPH

V_3 Juvenile foraging depth

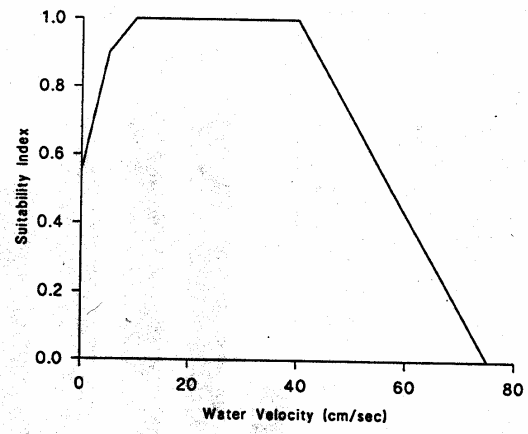
m	SI
0.6	0.0
2.0	0.7
4.0	1.0
7.0	1.0
14.0	0.0



SUITABILITY INDEX GRAPH

V_4 Juvenile foraging water velocity

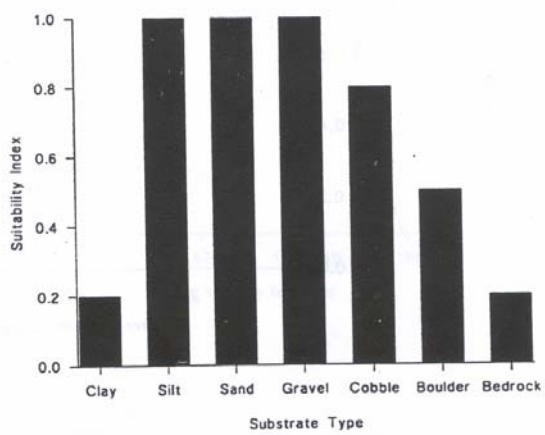
cm/sec	SI
0	0.5
5	0.9
10	1.0
40	1.0
75	0.0



SUITABILITY INDEX GRAPH

V_2 Juvenile foraging substrate type

Substrate	SI
Clay	0.2
Silt	1.0
Sand	1.0
Gravel	1.0
Cobble	0.8
Boulder	0.5
Bedrock	0.2

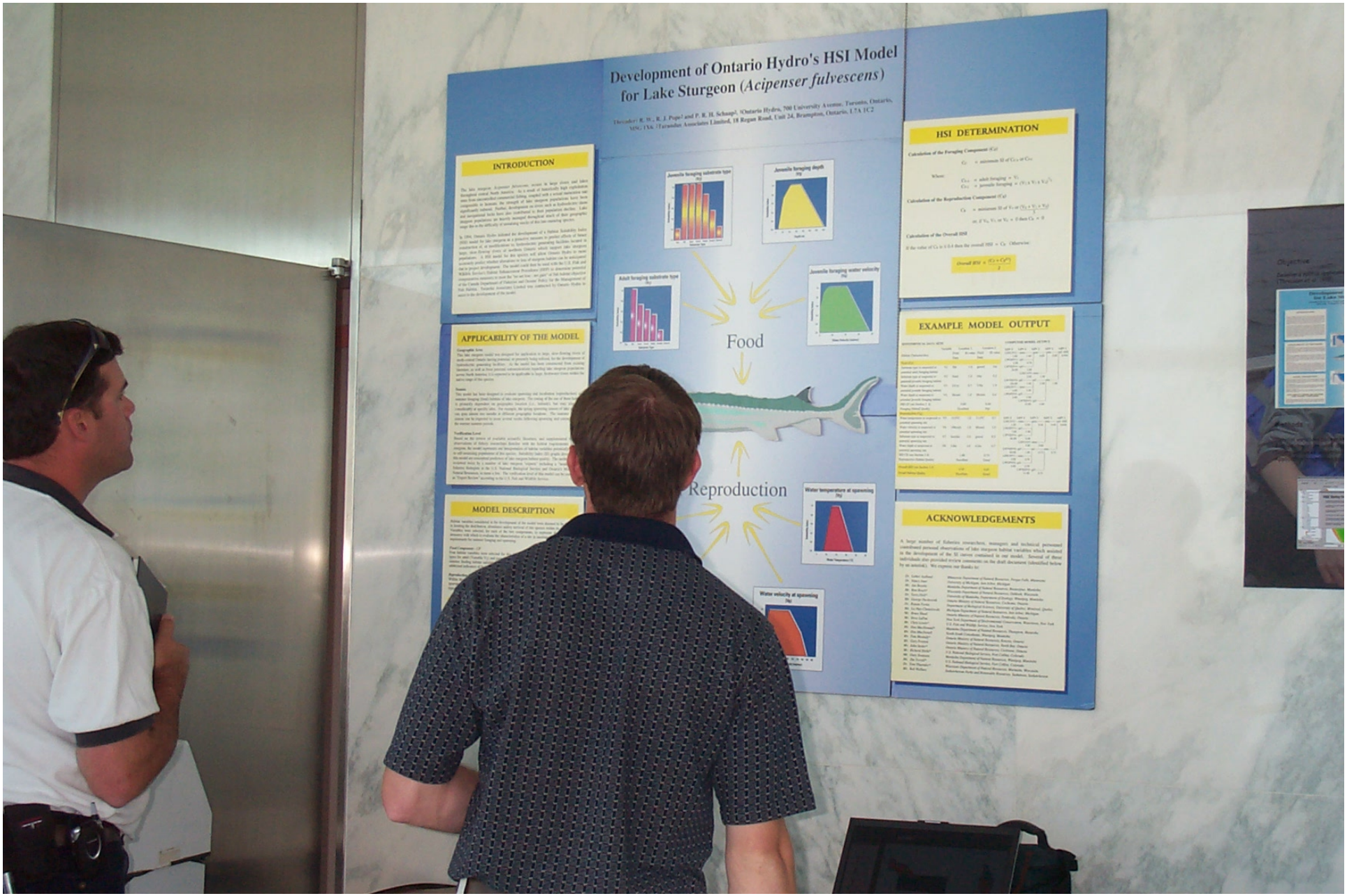


Study: TEST 1-15-1998

Model: LAKE STURGEON (riverine)

CoverType: RIVERn SubArea: RIVERn

```
LEV 5      LEV 4      LEV 3      LEV 2      LEV 1
  LSSUJV2---mnu-------gem-------min-------usf--HSI
       1.00       0.20 |     0.44 |     0.44 |  0.648
                       |          |          |
  LWDPJV3---grf-------|          |          |
       7.00       1.00 |          |          |
                       |          |          |
  LWVEJV4---grf-------^          |          |
      60.00       0.43           |          |
                                 |          |
            LSSUAV1---mnu-------^          |
                 4.00       0.60           |
                                           |
  LWVESV6---grf-------usf-------min-------^
      60.00       1.00 |     0.83 |     0.73
                       |          |
  LSSUSV7---mnu-------|          |
       4.00       0.50 |          |
                       |          |
  LWDPSV8---grf-------^          |
       4.00       1.00           |
                                 |
            LWTESV5---grf-------^
                11.00       0.73
```

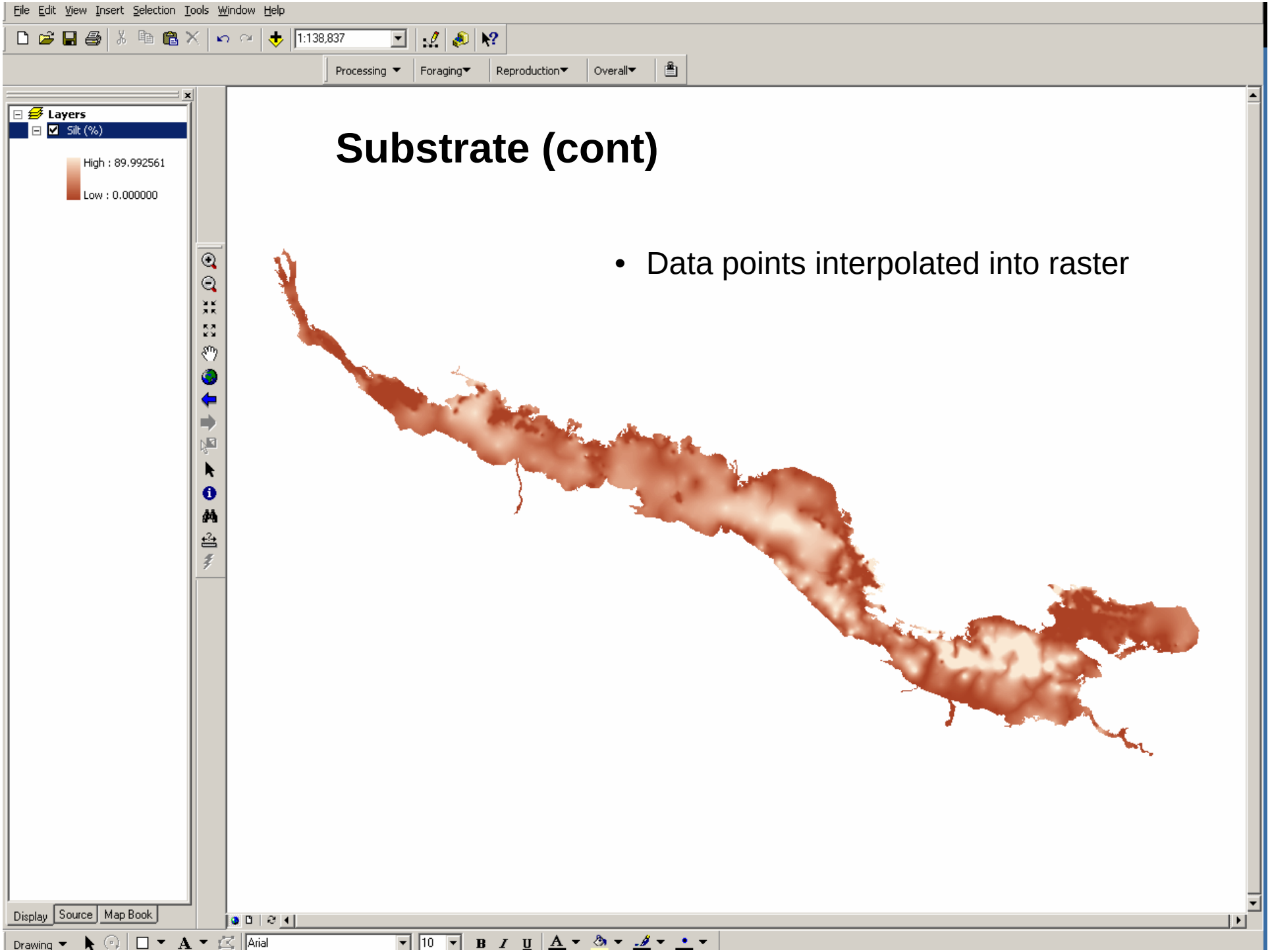

Development of Ontario Hydro's HSI Model for Lake Sturgeon (Acipenser fulvescens)
INTRODUCTION
APPLICABILITY OF THE MODEL
MODEL DESCRIPTION
HSI DETERMINATION
EXAMPLE MODEL OUTPUT
ACKNOWLEDGEMENTS
Food
Reproduction

Substrate

- sampled substrate
  - Eckmann dredge, Aqua Vu
- defined substrate (% silt, sand, clay etc)
- sites 300 m apart or definite change in habitat
- captured on a Pencentra

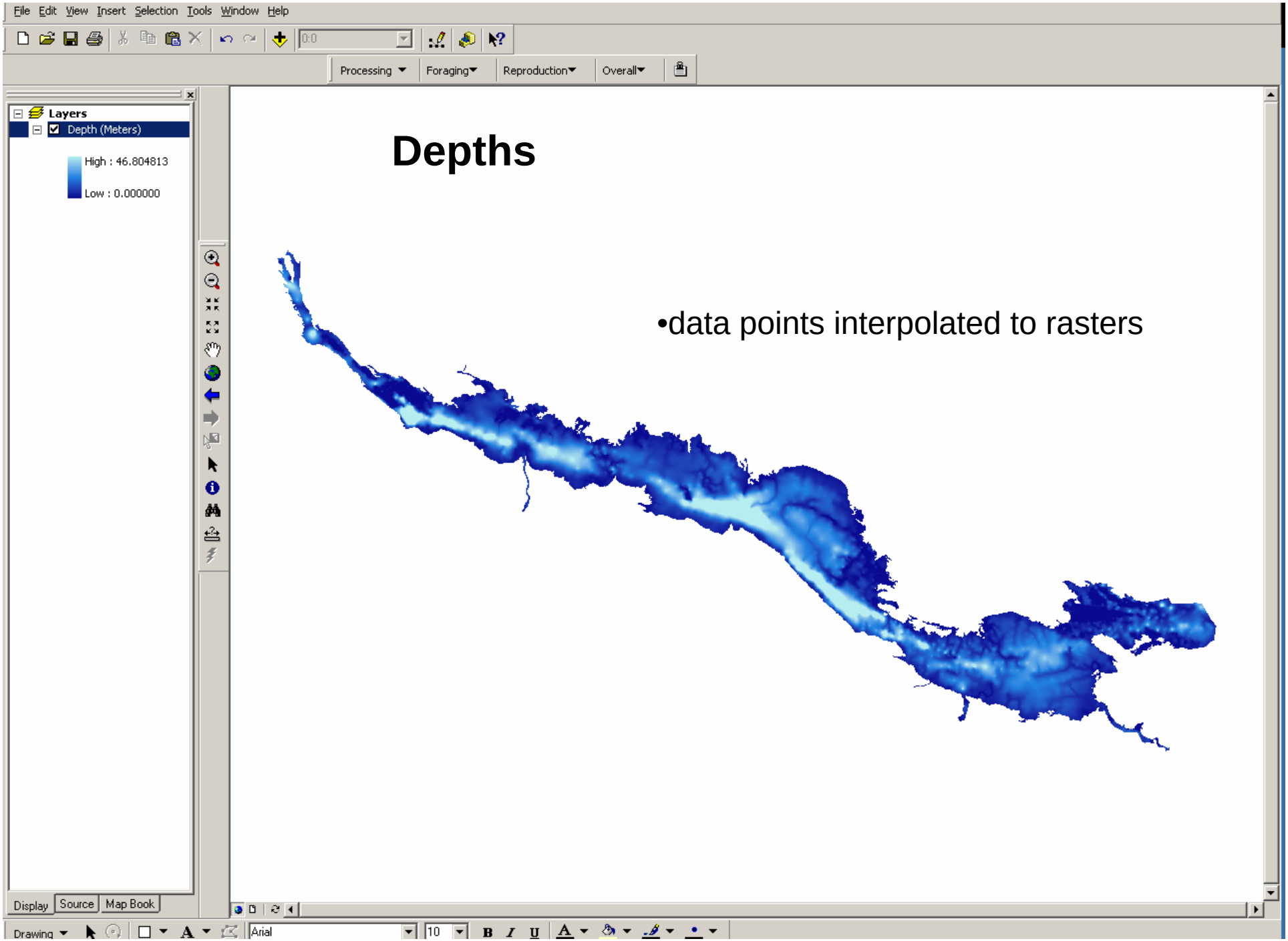
Substrate (cont)

- Data points interpolated into raster



Depths

- digitized bathymetric maps
- utilized bathymetric survey system (BASS)



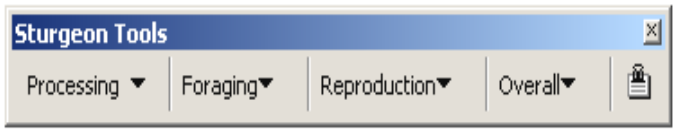
Depths

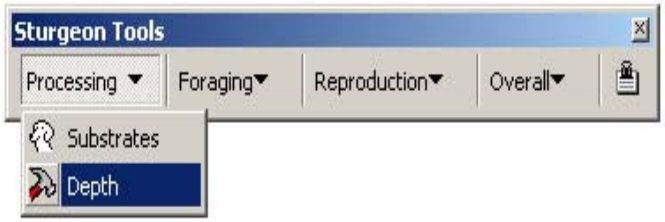
•data points interpolated to rasters

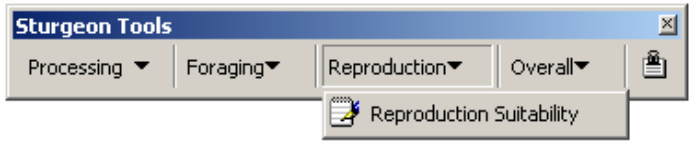
Flows

- monitoring stations set up at rapids/below dams
- hydro-acoustics conducted throughout reach

HSI Spatial Application

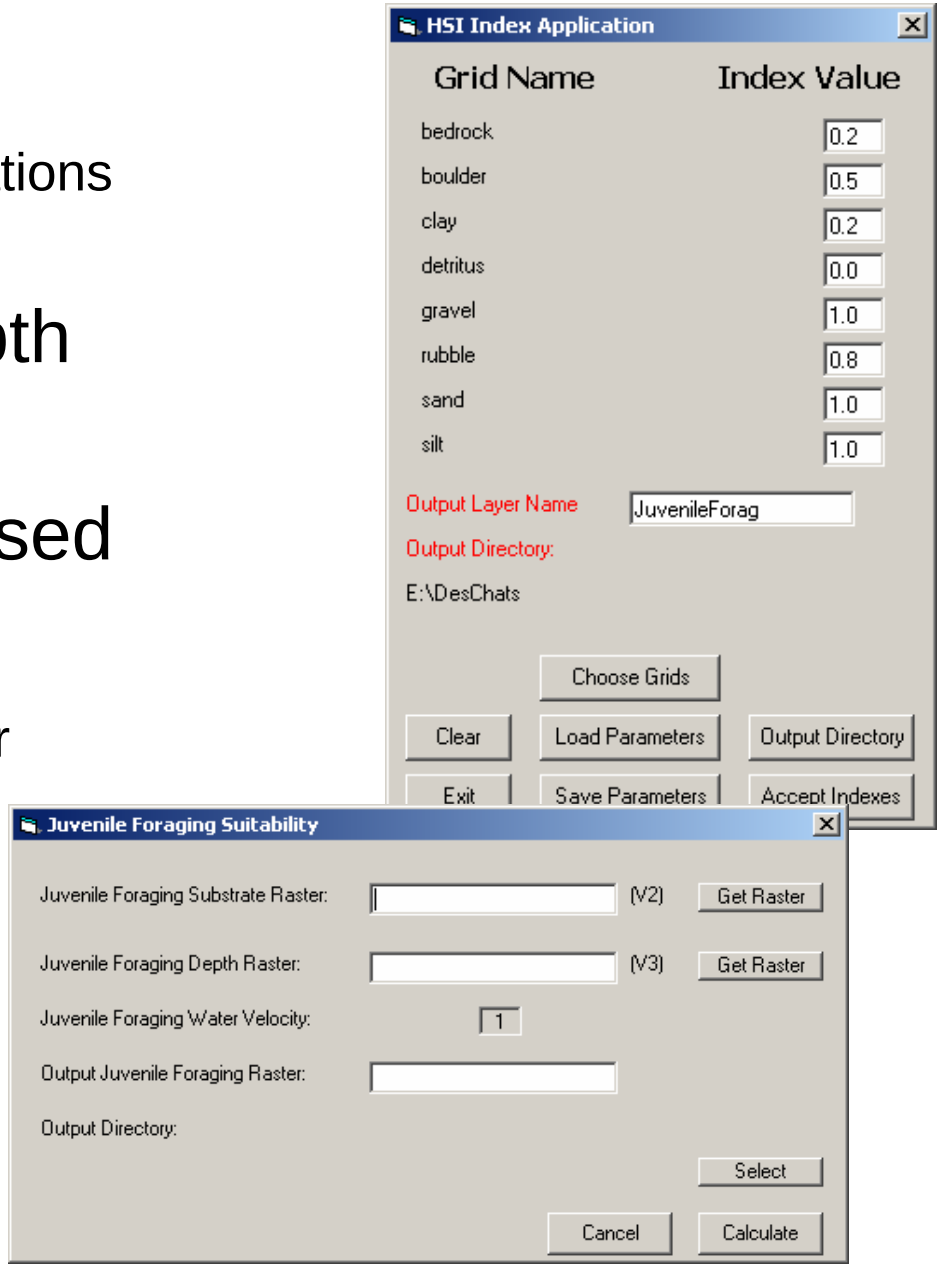


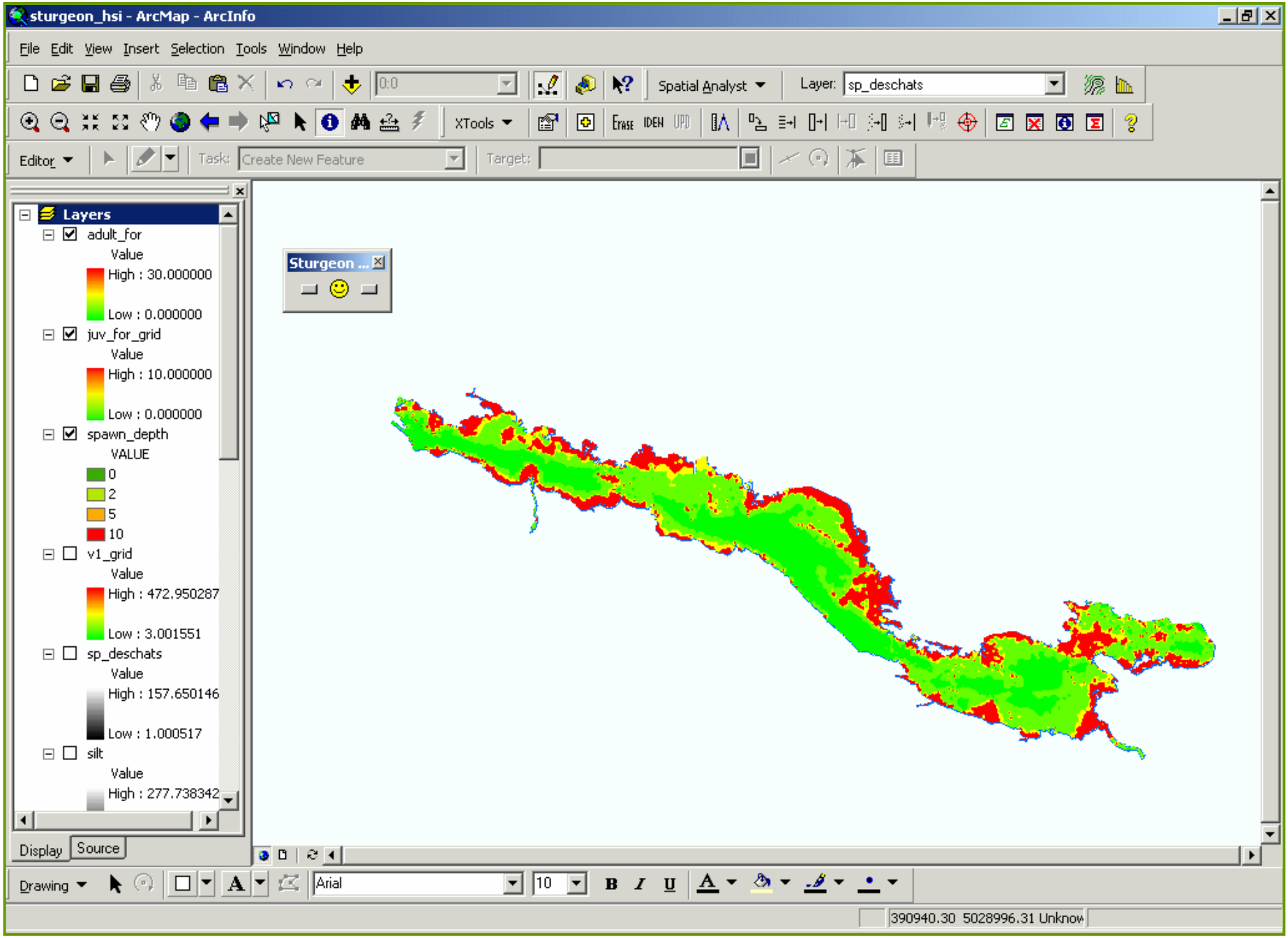


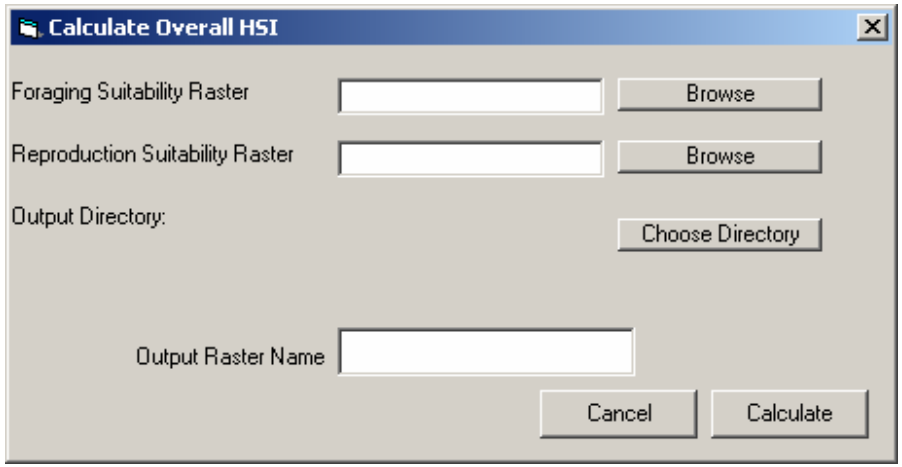


- developed for ArcMap 8.3
- programmed in Visual Basic
- presented as a toolbar (i.e. extension)

- uses SI's from Threader et al. (equations programmed for graphs)
- uses substrate, depth rasters
- calculates value based on inputs
- resolution 10 m (user defined)
- outputs are rasters




sturgeon_hsi - ArcMap - ArcInfo
File Edit View Insert Selection Tools Window Help
Spatial Analyst
Layer: sp_deschats
XTools
Editor
Task: Create New Feature
Target:
Layers
adult_for
Value
High : 30.000000
Low : 0.000000
juv_for_grid
Value
High : 10.000000
Low : 0.000000
spawn_depth
VALUE
0
2
5
10
v1_grid
Value
High : 472.950287
Low : 3.001551
sp_deschats
Value
High : 157.650146
Low : 1.000517
silt
Value
High : 277.738342
Display
Source
Sturgeon ...
Drawing
Arial
10
390940.30 5028996.31 Unknow



- calculates overall HSI for reach

Model validation

- substrate interpolations
- model predictions