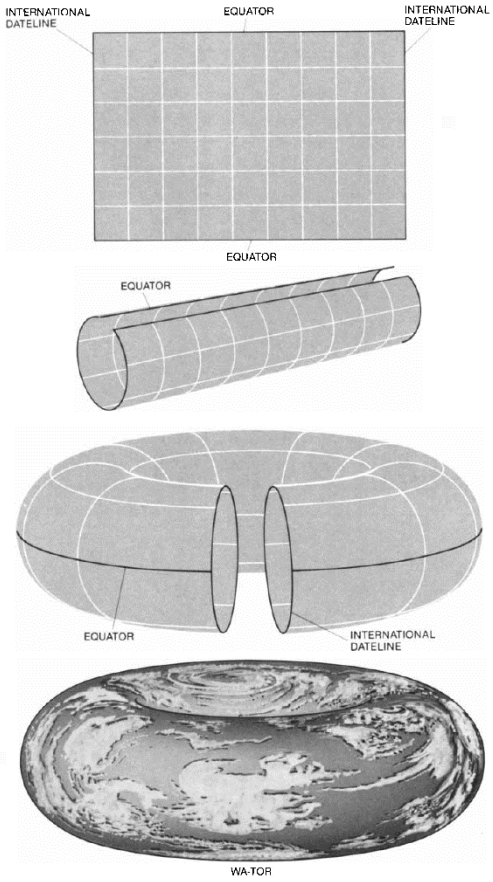
# Computer modeling of physical phenomena

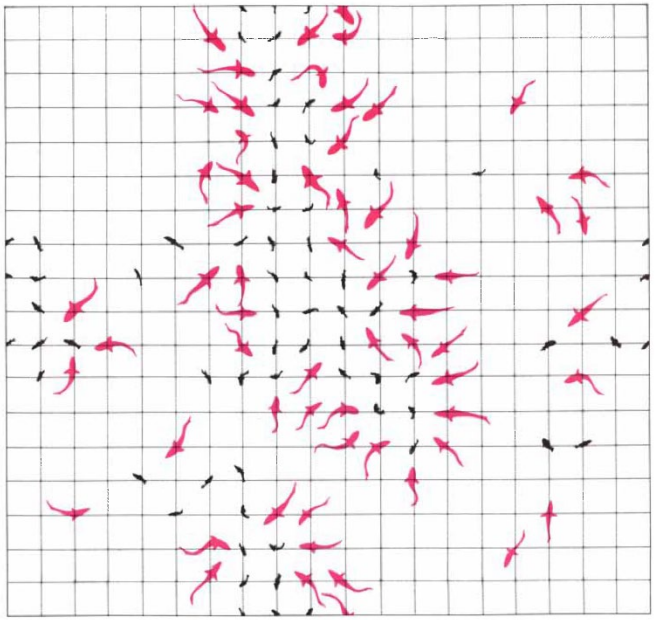

Lab 13: Wa-Tor

# Wa-Tor Universe

Somewhere, in a direction that can only be called recreational at a distance limited only by one's programming prowess, the planet Wa-Tor swims among the stars. It is shaped like a torus, or doughnut, and is entirely covered with water. The two dominant denizens of Wa-Tor are sharks and fish, so called because these are the terrestrial creatures they most closely resemble. The sharks of Wa-Tor eat the fish and the fish of Wa-Tor seem always to be in plentiful supply.

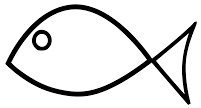
*A. K. Dewdney, Scientific American 12/1984, pp.14-22*



NxN grid, periodic boundary conditions, fish, sharks and empty spaces

# Rules:



1. In each unit of time the fish moves to one of the unoccupied adjacent fields.
2. If there are no such fields - it does not move.
3. Once in A steps the fish reproduces, leaving a new fish on the place from which it moved.

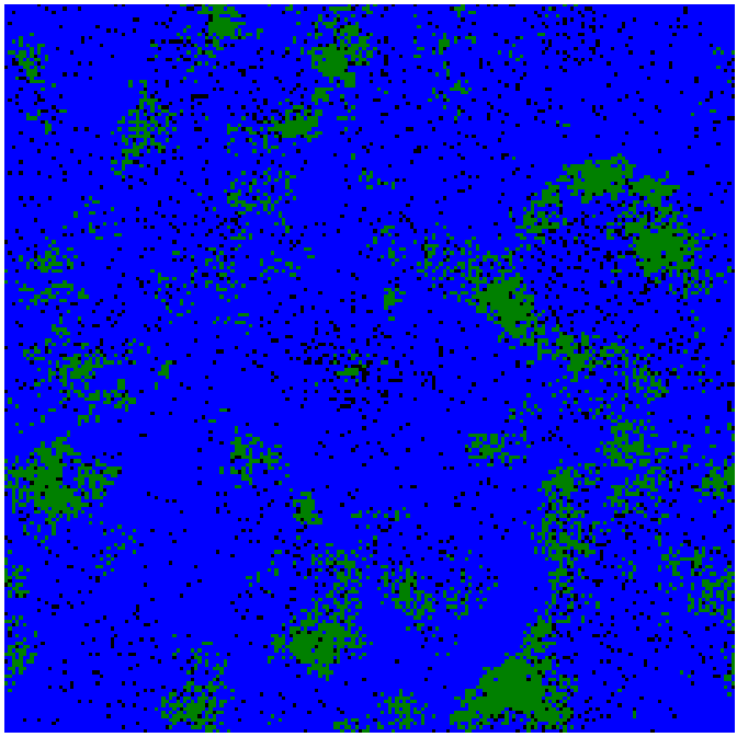
1. In each unit of time the shark moves to one of the adjacent fields occupied by the fish.
2. If there are no such fields, it moves to one of the unoccupied adjacent fields.
3. If there are no such ones either - it does not move.
4. In each step the shark loses a unit of energy, if the energy drops to zero - the shark dies.
5. When the shark enters a field occupied by a fish - it eats it, and its energy increases to the initial level (E).
6. Once every B steps, the shark reproduces, leaving a new shark on the place from which it moved.

# Your task:

1. Write the code tracking Wa-tor world on 40x40 lattice (prepare animation)
2. Plot $N_{fish}(t)$ and $N_{shark}(t)$ for 40x40 and 200x200 lattices. What can you say about these graphs? Then analyze the evolution of the system in coordinates ($N_{fish}$, $N_{shark}$).

Example parameter values: 40x40 lattice, A=3, B=20, E=3, $N_{fish}(0)=300$, $N_{shark}(0)=10$

# Visualization



Fish - green, sharks - black, water - blue