Seasonal Hypoxia Cycle

- Highest oxygen in surface & mid-depths during spring
  - Begins dropping in mid-depths & deep water with spring phytoplankton growth
  - Reach minimum in late summer

www.hoodcanal.washington.edu/observations/historicalcomparison.jsp

Seasonal Hypoxia Cycle

- Flushing of deep water typically occurs once a year in late summer
  - Dense cold ocean water from outer coast
  - More oxygen than deep HC water but less than surface
- Leaves low-oxygen layer “sandwiched” at mid-depths
  - Just below surface layer
  - Gradually gains oxygen through winter by mixing with surface water

www.hoodcanal.washington.edu/observations/historicalcomparison.jsp

Hypoxia Getting Worse

- Oxygen in deep waters of Hood Canal reached an all-time low in 2004
  - Known to be low-O2 even in 1950’s – 1960’s
  - “More severe, more persistent” recently
  - Closed fisheries for bottomfish in 2002, 2003
    - Major fish kill because of low oxygen Oct. 2003
    - 2 milligrams/liter a “Dead Zone”
    - Closure made permanent Aug. 2004
  - Herring, smelt, crab, shrimp, squid, octopus, cucumbers

www.hoodcanal.washington.edu/observations/historicalcomparison.jsp
wdfw.wa.gov/shelfish/crabreg/area12.shtml
wdfw.wa.gov/do/newreal/release.php?id=aug0904b

Average >20m Dissolved Oxygen Measurements – 1950s - 2004

Southern Hood Canal (DB to GB)

www.hoodcanal.washington.edu/observations/historicalcomparison.jsp

Warner (UIW) analysis: UW Collins & PRISM data
Hypoxia Getting Worse

www.hoodcanal.washington.edu/observations/winterconditions03-04-3.html

Theories of Hypoxia

- Changes in production or input of organic matter
  - Natural due to better growth conditions
    - E.g. more sunlight, more nutrients
  - Human-caused nutrient enrichment
    - Septic tanks, fertilizer, salmon carcasses
- Changes in properties of incoming ocean water
  - Density, nutrients, oxygen
  - El Niño

www.hoodcanal.washington.edu/aboutHC/whatdoweneedtoknow.html

What Citizens Can Do

www.psat.wa.gov/Programs/hoodcanal/what_you_can_do.htm

- Take care of your septic system
  - Treat nutrients as well as bacteria
- Use little or no fertilizer (esp. before rain)
- No grass clippings, yard waste, pet or livestock waste in water
- Control stormwater runoff
- Grow shellfish (remove plankton)
- Control boating & fishing waste
- Get educated & involved
Monitoring Hood Canal

- ORCA (Oceanic Remote Chemical-Optical Analyzer) Buoy moored in upper Hood Canal

www.hoodcanal.washington.edu/observations/orca_buoy.jsp

ORCA BUOY 2005-06

- Strong stratification July - Sept.
- Deep oxygen deficit same months

Long-term Research

- IAM (Integrated Assessment & Modeling)
  3-year study
  - Whether & which human activities may contribute to hypoxia
  - Scientific monitoring & modeling
  - Cooperation with local, tribal, state & federal regulators
  - Begun 2005 with mainly U.S. Navy $$
    - UW Applied Physics Lab
    - Hood Canal Salmon Enhancement Group

www.hoodcanal.washington.edu/iam_study/approach.html
Long-term Research

- Citizen volunteer monitoring
  - Hood Canal Salmon Enhancement Group
    - hcesg.org
  - Trained by UW Aug. 2003
  - Weekly sampling at red dots

Managing Puget Sound

- Federal programs
  - Clean Water Act
  - National Estuary Program
  - Both administered by Environmental Protection Agency (EPA)
    - Supervise state agencies
    - In Washington, Puget Sound Action Team
    - Provides some funding

Puget Sound Water Quality Action Team

- A branch of the Governor’s Office
  - Mainly a planning & coordinating agency
  - No enforcement power
- Main functions
  - Work with all constituencies to formulate long-term Puget Sound Water Quality Management Plan
  - Work with all constituencies to develop two-year Puget Sound Work Plan
  - Guide implementation of the plan

Managing Hood Canal

- Puget Sound Water Quality Action Team
  - Chair + Directors of 10 state agencies
  - Representatives from tribal, federal, local governments
  - Puget Sound Council advises Action Team
    - Representatives from community & industry
  - Action Team staff
    - Conducts & guides research
    - Gathers & disseminates information
    - Conducts public education
    - Advocates for Sound conservation
Highlights of Puget Sound Plan 2005-07
www.psat.wa.gov/Publications/biennialplan/05_07_PSplan.htm

Managing Hood Canal
www.psat.wa.gov/Programs/hoodcanal/hc_helping.htm

• State House of Representatives has “Select Committee on Hood Canal”
  – www1.leg.wa.gov/house/Committees/hood
• HCDOP has two branches
  – IAM (research)
  – “Corrective Action & Education Group”
    • Run by Puget Sound Action Team & Hood Canal Coordinating Council
    • Educates & involves residents for water quality
    • Preliminary assessment, corrective actions, demonstration projects

Legislative Actions
2005-2007 Biennium
www.psat.wa.gov/Programs/hoodcanal/hc_funding.htm

• Total $21.2 million appropriated
  – Test septic technologies to capture nitrogen
  – Support fish carcass removal from tribal hatchery, abatement ponds at state hatchery
  – Public education & involvement
  – Rehabilitation planning program
  – Design & build sewer & storm water systems
  – Fund tracking of failing septic tanks
  – Low-interest loans to homeowners
  – Control & process livestock waste

Legislative Proposals 2006
www.psat.wa.gov/Programs/hoodcanal/hc_monthly_reports.htm

• State Senate
  – Require dischargers & onsite sewage systems (septic) to remove nutrients on Hood Canal
• State House
  – Sales & use tax exemptions for construction of onsite sewage systems on Hood Canal
  – Separate state fund for Hood Canal protection & restoration (no funding source identified)
  – Study fate & transport of nutrients from onsite sewage systems into Hood Canal ($600K)
Governor’s Budget Proposals 2006


- $4 million to make state parks environmental models
  - Replace sewage systems @ 2 HC parks
- $6.5 million for grants & low-interest loans
  - To low-income homeowners for repairing & replacing failing septic systems
- $2.5 million for stormwater control
  - To local governments
  - Natural drainage systems, permeable pavement, etc.