Habitat Quality, Toxics, and Salmon in the Lower Columbia Estuary: Multi-Year Coordinated Fish, Fish Prey, Habitat and Water Quality Data Collection under the Ecosystem Monitoring Project

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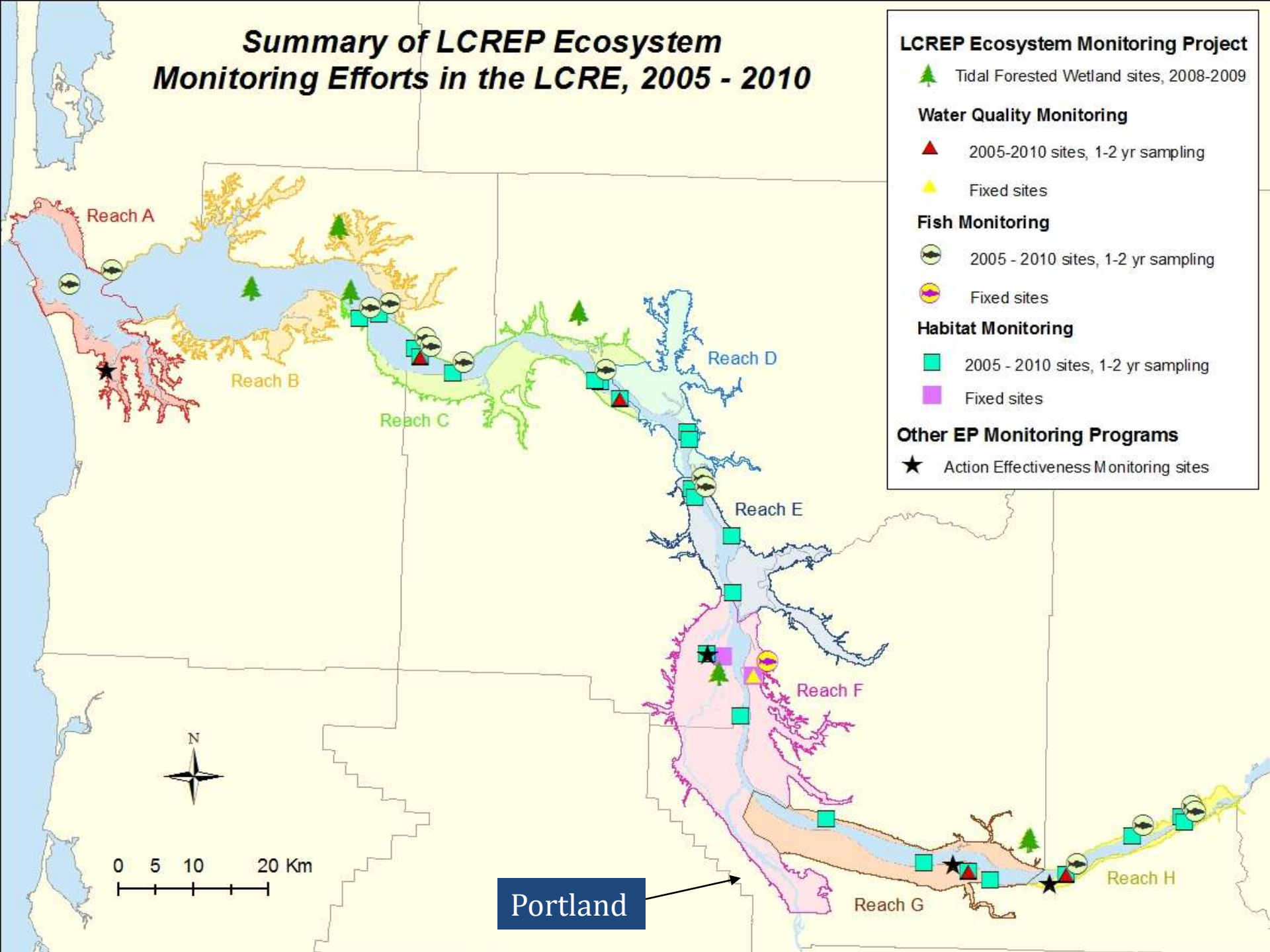
[4]Lower Columbia River Estuary Partnership, Portland, OR, USA

Lower Columbia Estuary Partnership Science Workgroup Meeting
October 23, 2012


Summary of LCREP Ecosystem Monitoring Efforts in the LCRE, 2005 - 2010
LCREP Ecosystem Monitoring Project
Tidal Forested Wetland sites, 2008-2009
Water Quality Monitoring
2005-2010 sites, 1-2 yr sampling
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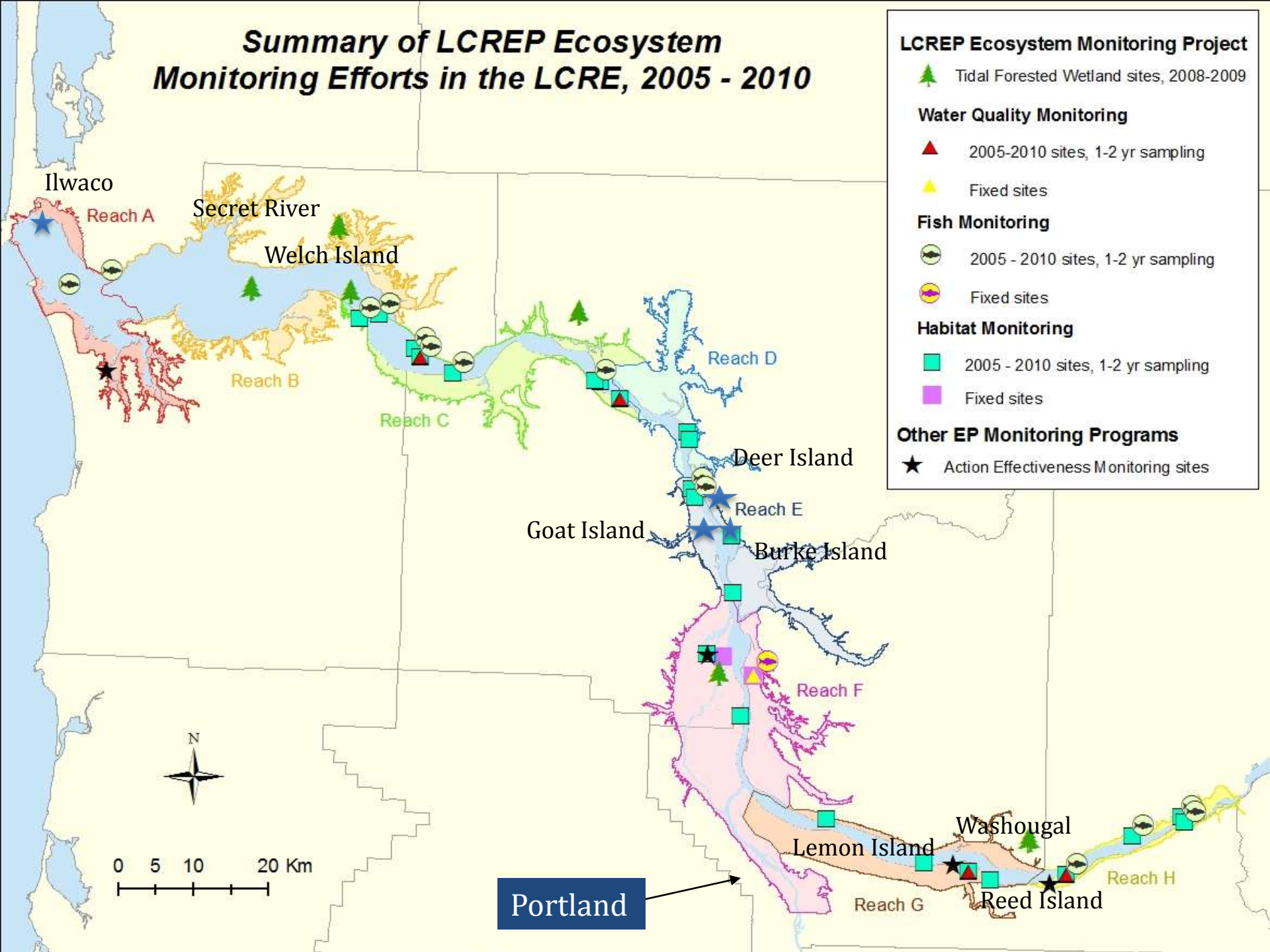
Other EP Monitoring Programs
Action Effectiveness Monitoring sites
Reach A
Reach B
Reach C
Reach D
Reach E
Reach F
Reach G
Reach H
N
0 5 10 20 Km
Portland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Deer Island
Reach E
Goat Island
Burke Island
Reach F
Washougal
Lemon Island
Reach H
Reach G
Reed Island
Portland
N
0 5 10 20 Km

Estuary Partnership's Ecosystem Monitoring Program

Major Program components:

- Water Quality (USGS)
- Vegetation Monitoring (PNNL)
- **Invertebrate prey (NOAA Fisheries)**
- **Fish (NOAA Fisheries)**

emergent vegetation tows

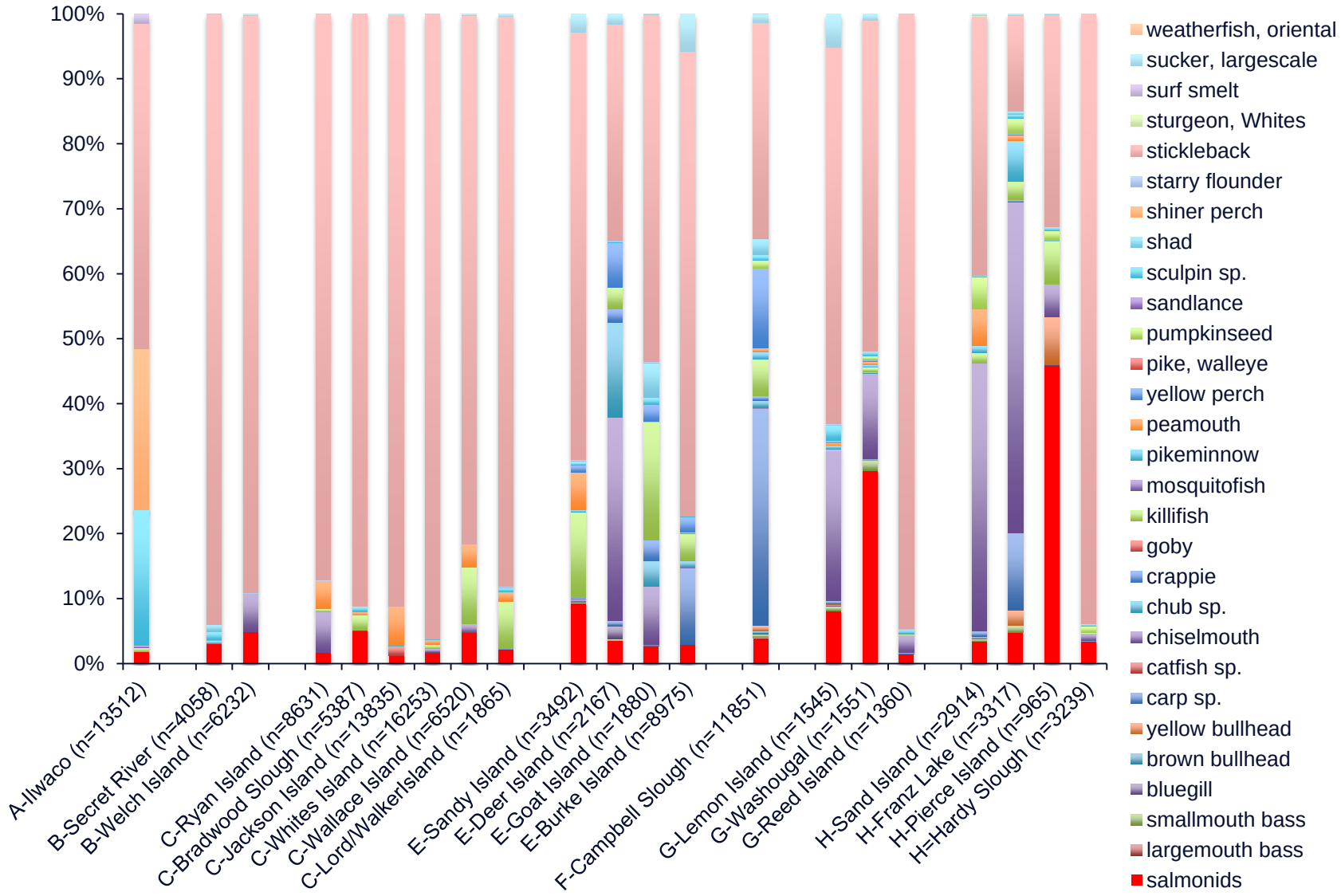

open water tows

beach seining

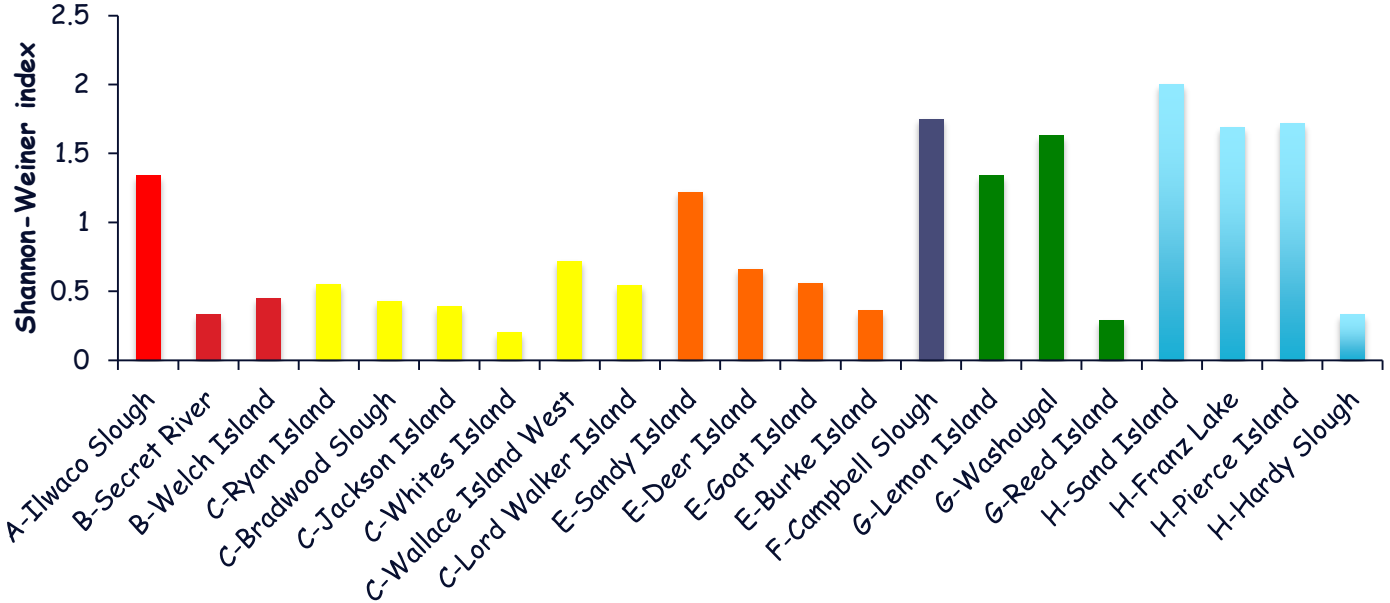
Ecosystem Monitoring Results

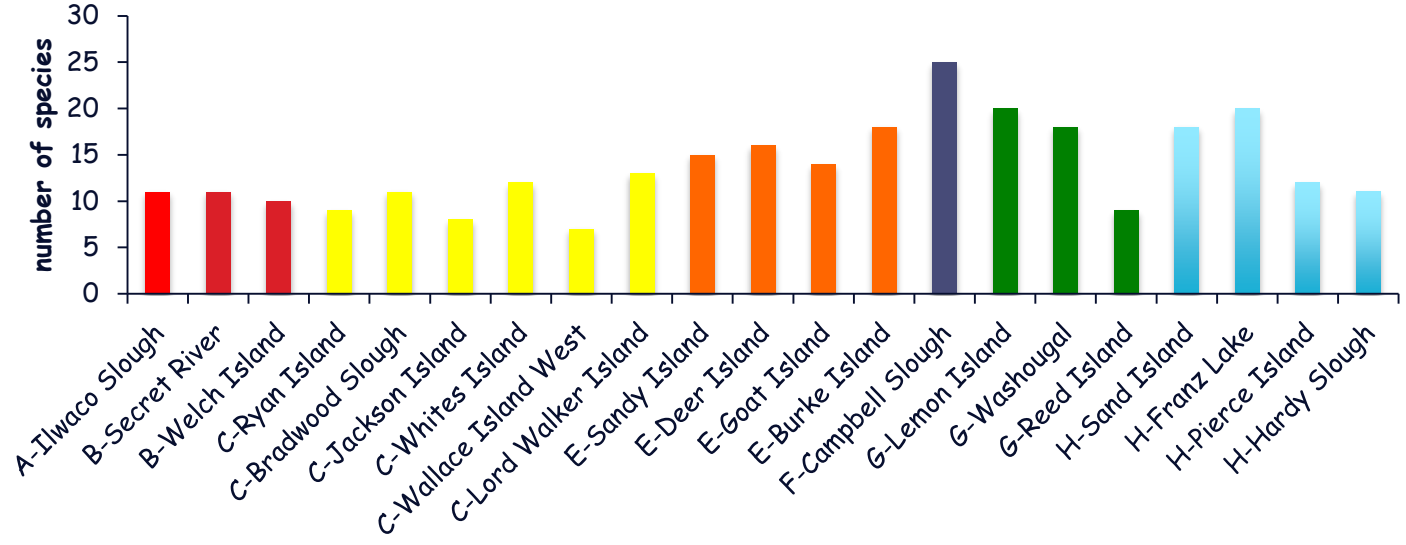
- Distinctive fish communities by reach

Fish Community Composition

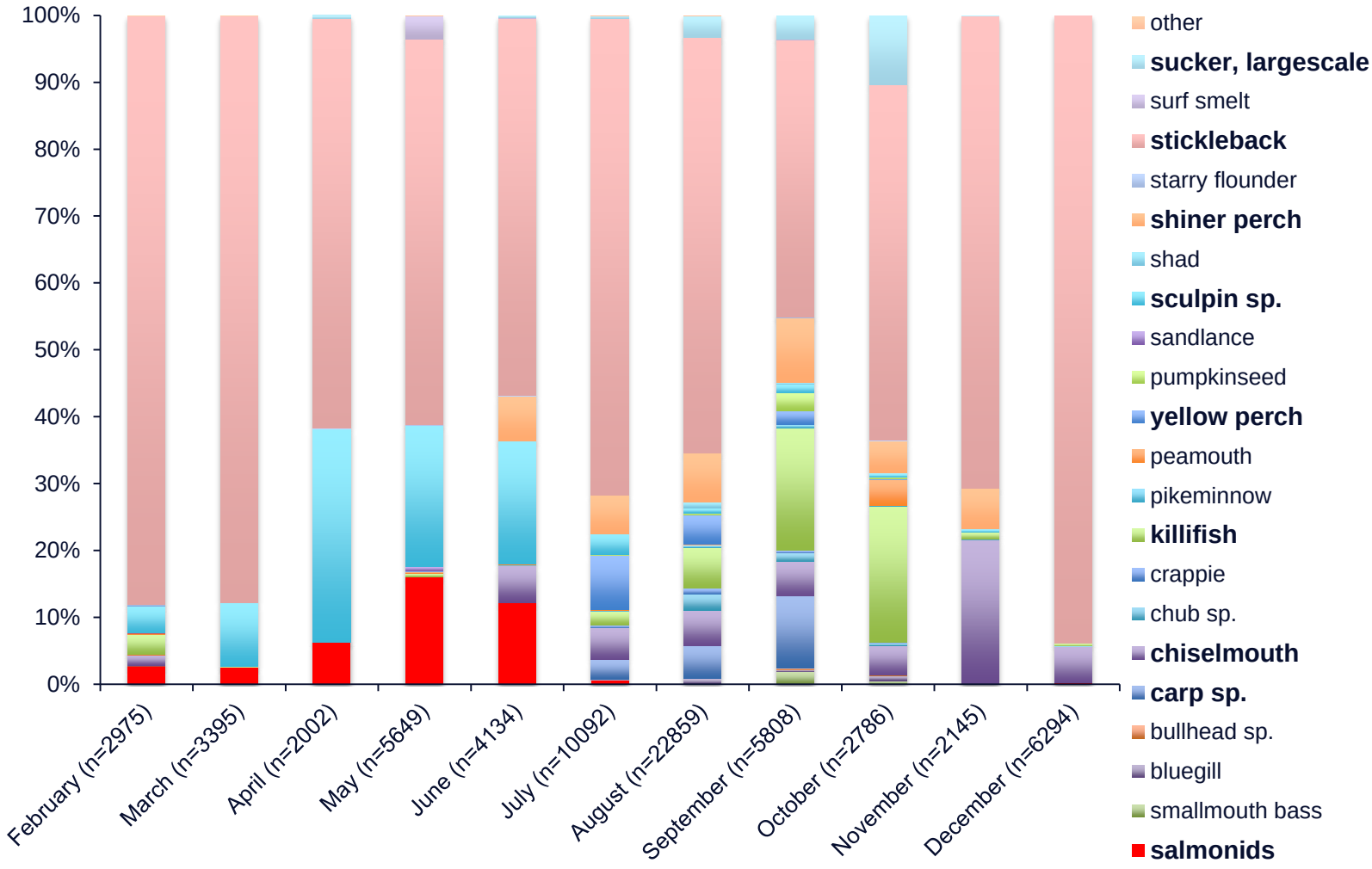


Species diversity and richness





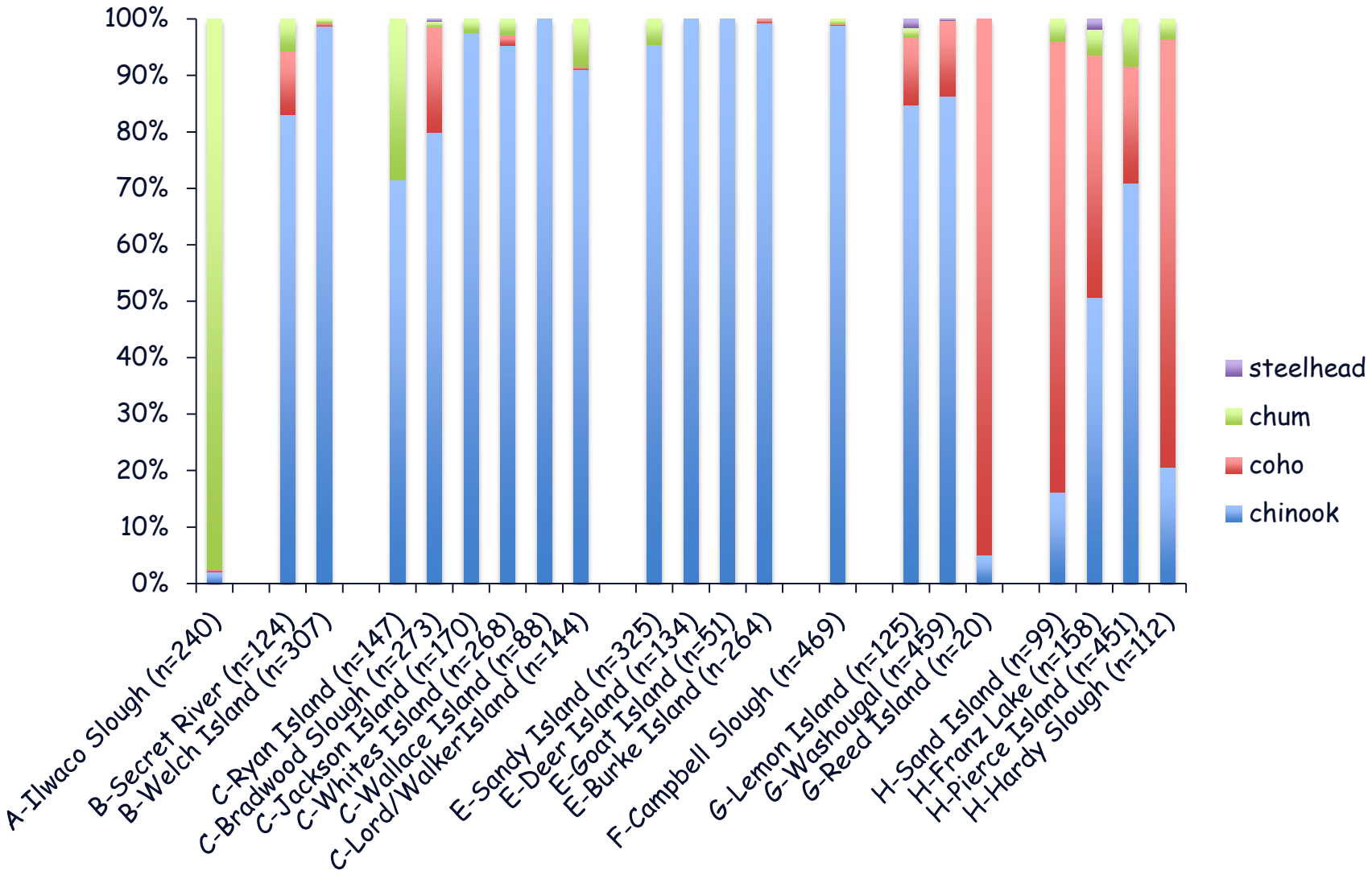
Fish Community Composition over the Sampling Season



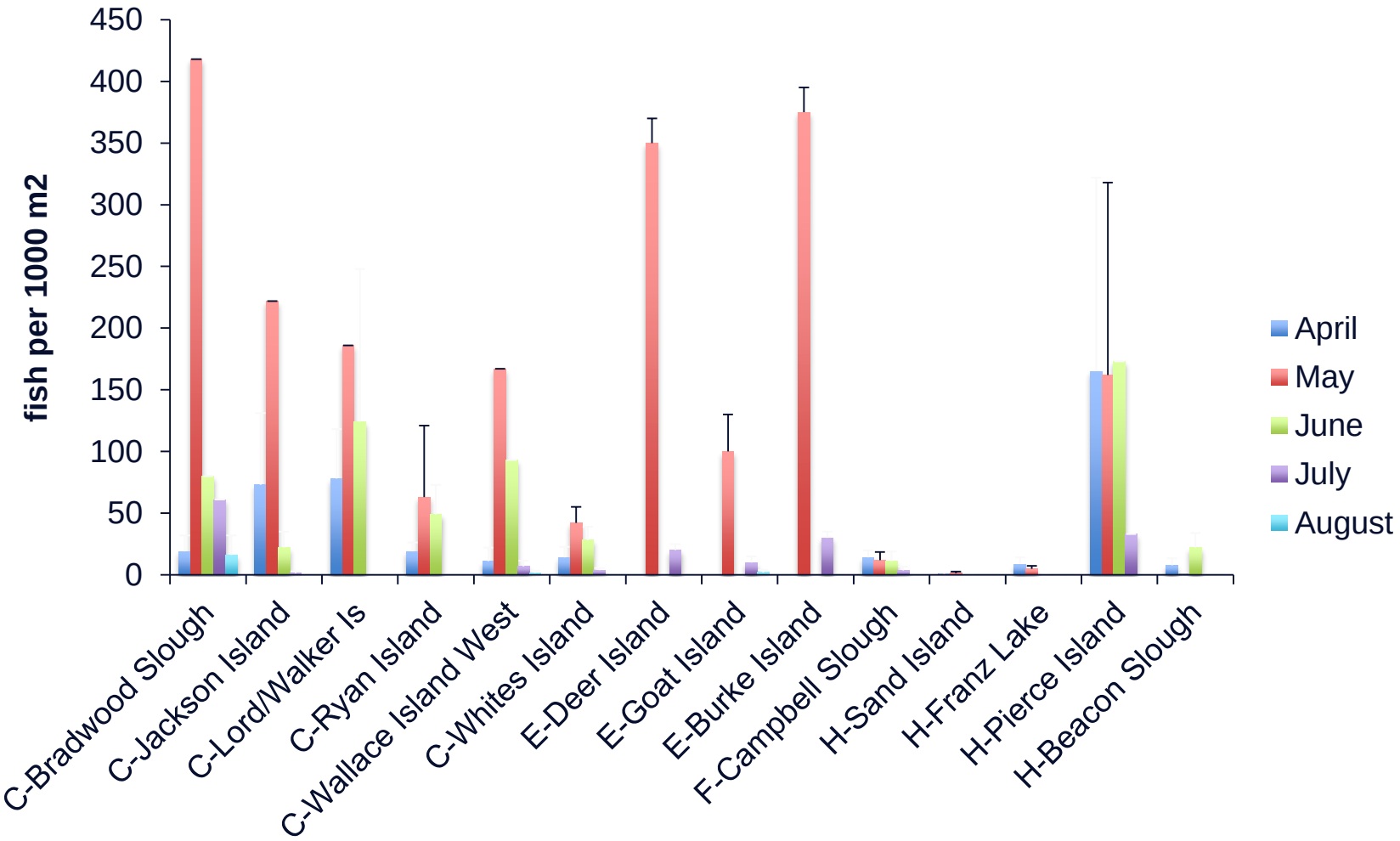
Ecosystem Monitoring Results

- Distinctive fish communities by reach
- Multiple salmon species and stocks with distinctive patterns of occurrence by reach

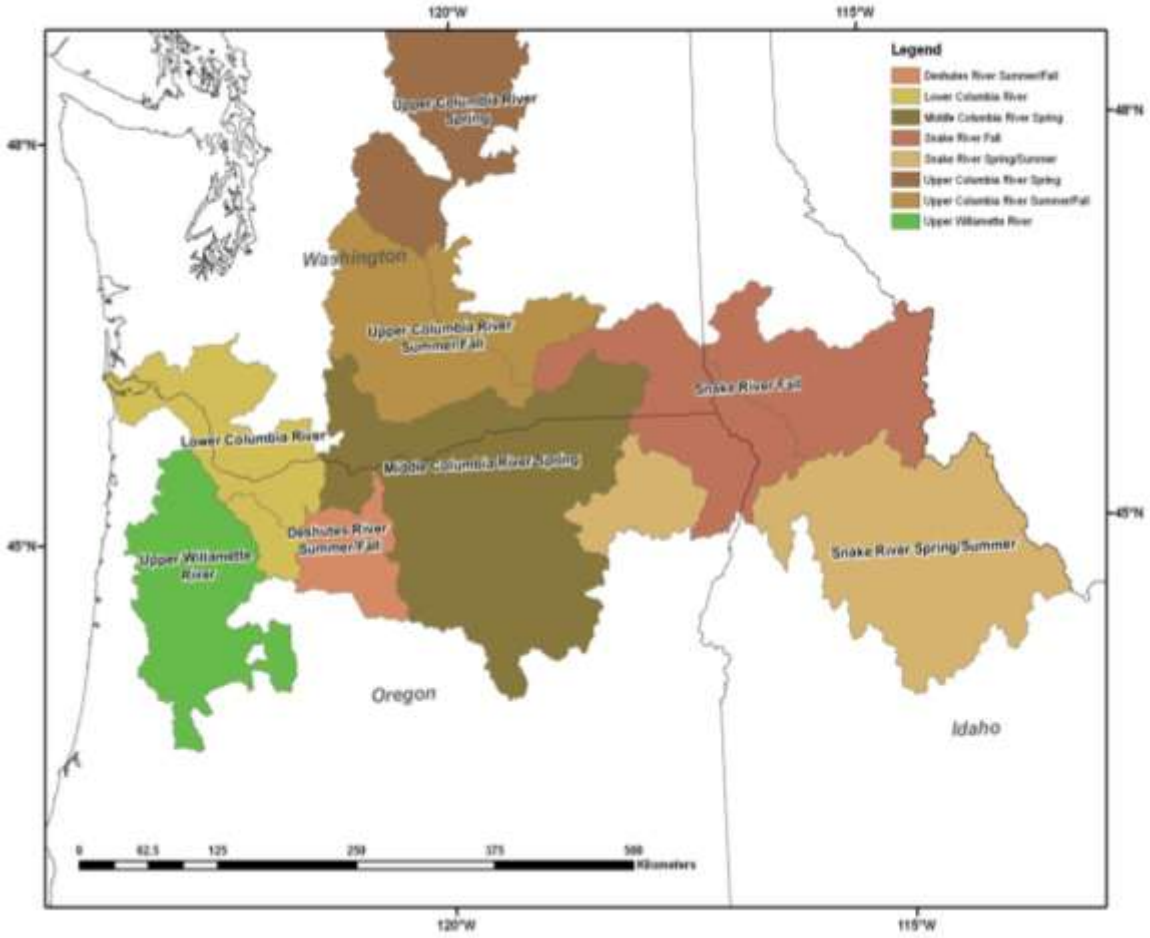
Salmonid Catch Composition



Unmarked Chinook density by site and month



Chinook Salmon Genetic Groups



Lower Columbia/Willamette Stocks:

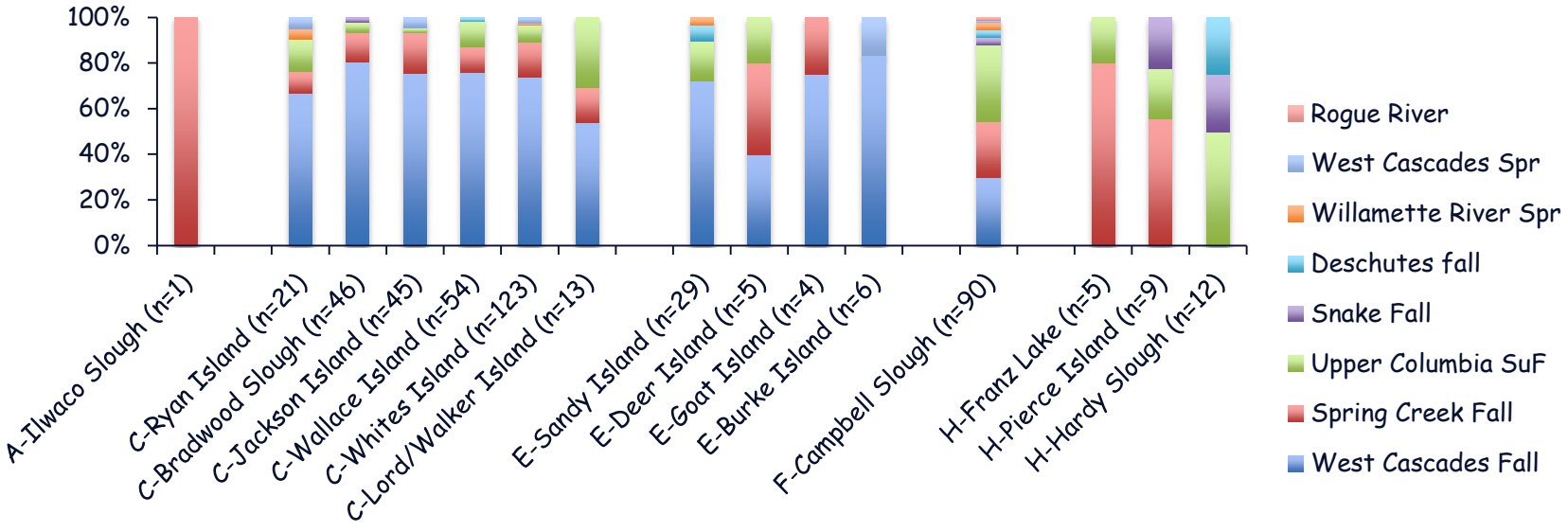
- West Cascade Range Falls
- West Cascade Range Springs
- Spring Creek Group Falls
- Upper Willamette Springs

Interior Columbia Stocks:

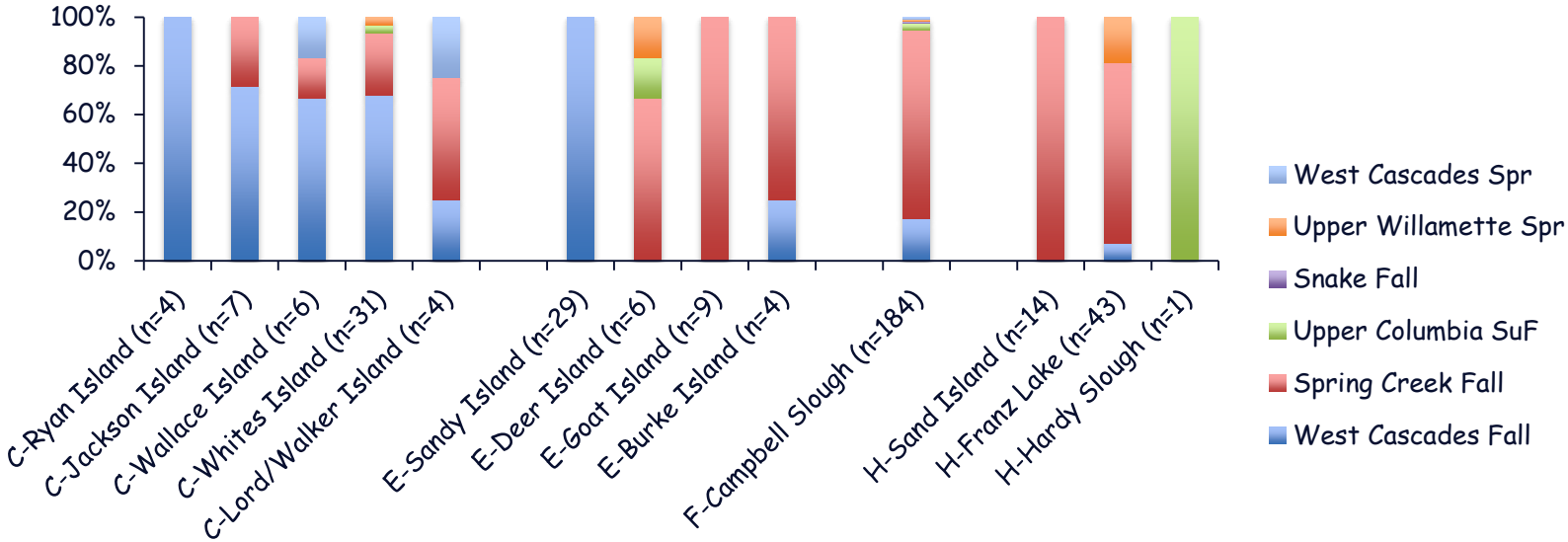
- Upper and Middle Columbia Springs
- Snake River Spring/Summers
- Snake River Falls
- Deschutes River Summer/Falls

Genetic Stocks

unmarked chinook



marked chinook



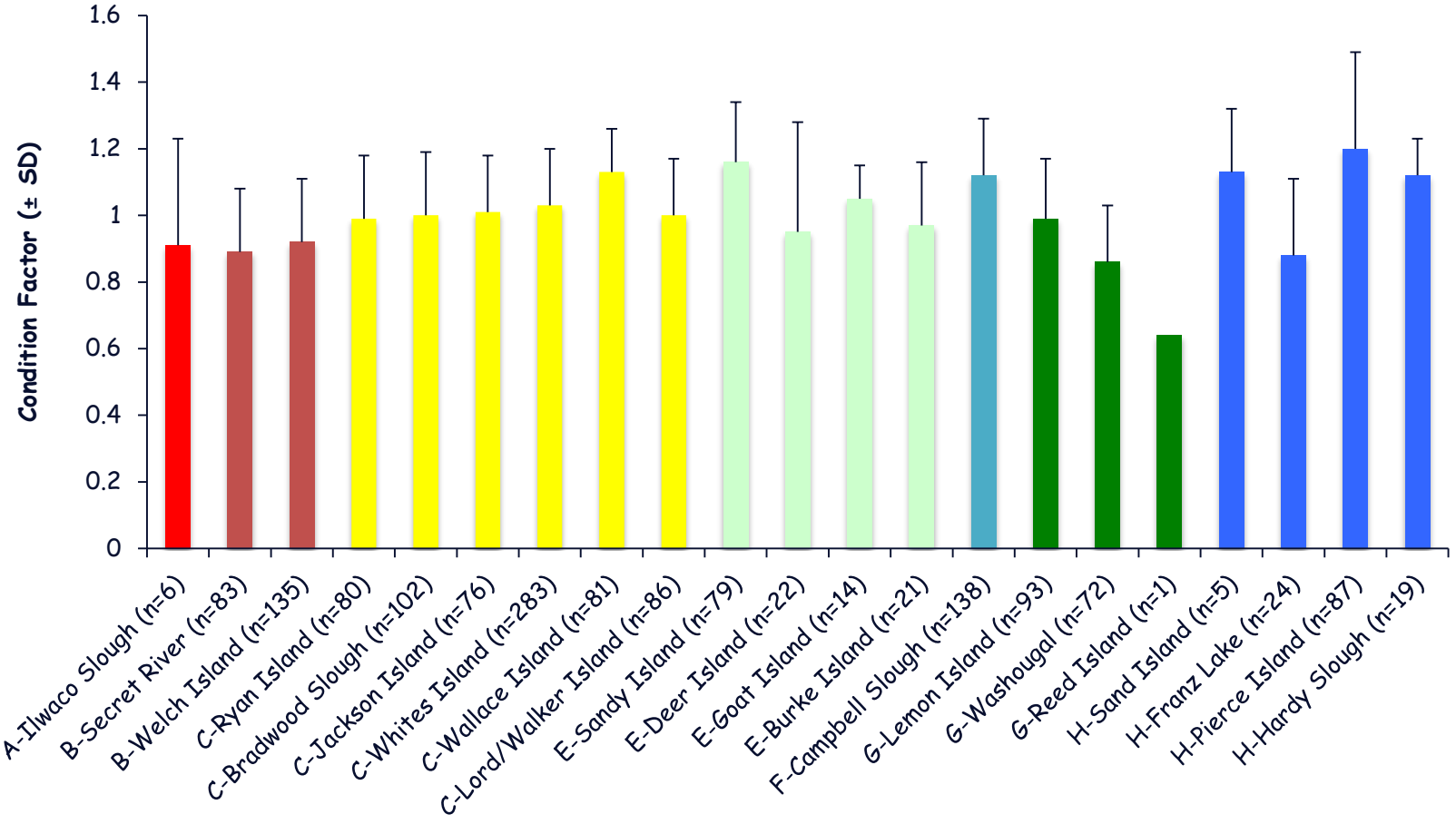
Campbell Slough PIT tag array results from 2011

Detection Date Range	No of fish detected	Range of days between first and last detections	Species	Tag site	Tag Date Range
6/3/11	1	5	Northern pike minnow	Mouth of Lewis River	4/3/10
7/12/11-7/20/11	7	1-12	Chinook salmon	Little White Salmon Hatchery (Columbia Gorge, WA)	6/6/11-6/7/11
7/12/11	5	1-3	Chinook salmon	Lyons Ferry Hatchery (Snake River, WA)	4/13/11-4/16/11
7/12/11	3	1-8	Chinook salmon	Dworshak Hatchery (Clearwater River, ID)	5/26/11-6/6/11
7/12/11	1	9	Chinook salmon	Irrigon Hatchery (Middle Columbia, OR)	4/20/11
7/13/11	4	10	sockeye salmon	Sawtooth Hatchery (Salmon River, ID)	4/6/11

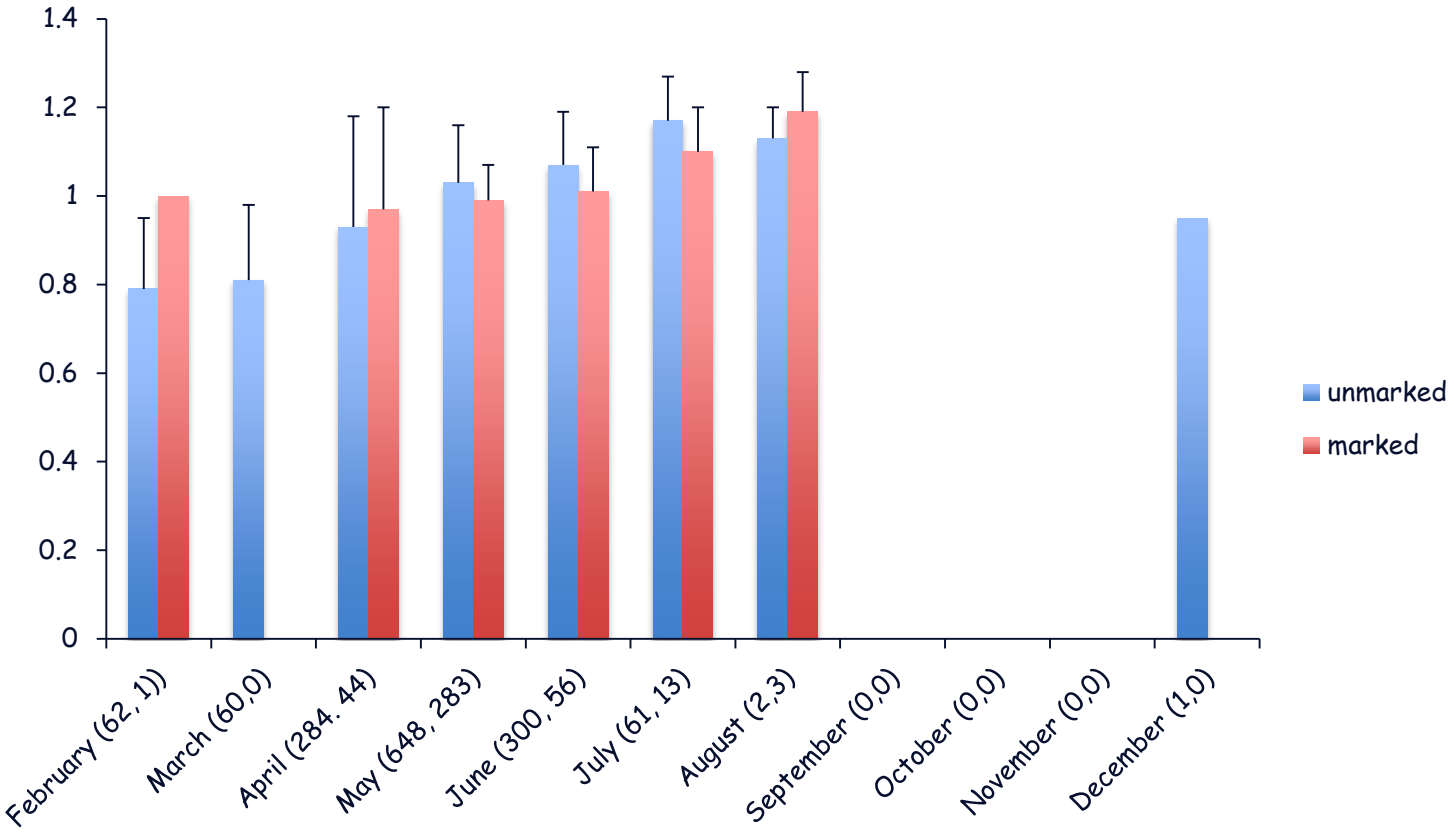
Ecosystem Monitoring Results

- Distinctive fish communities by reach
- Multiple salmon species and stocks with distinctive patterns of occurrence by reach
- Measures of fish condition

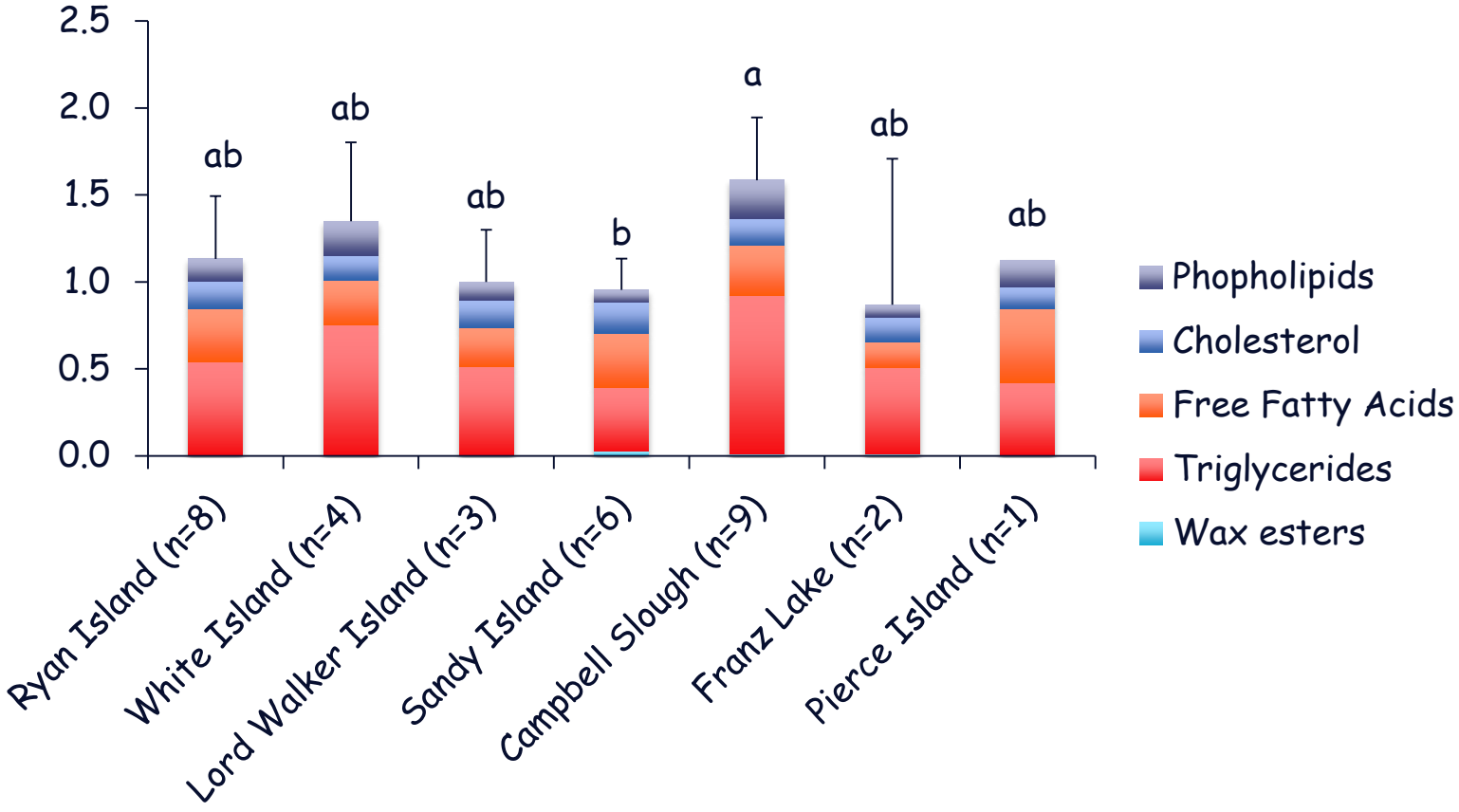
Fish condition factor by site for unmarked chinook



Fish condition factor by month unmarked chinook

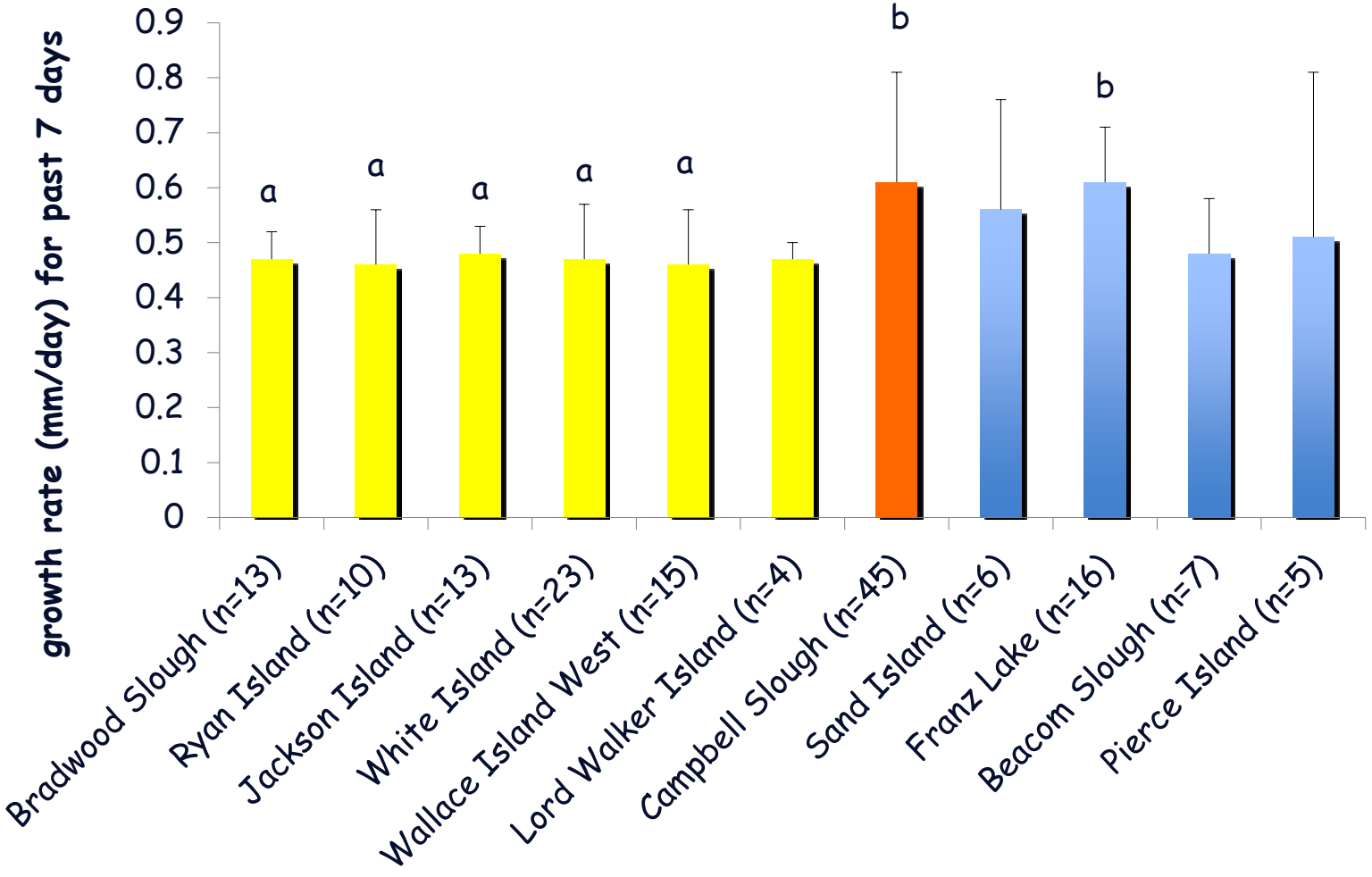


Lipid Content in unmarked Chinook salmon from EMP Sites



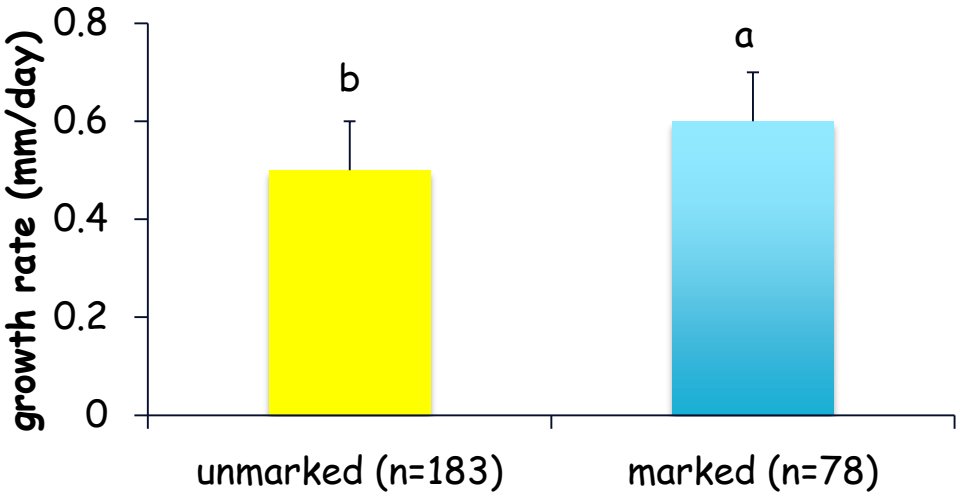
Lipid content typically 1-1.5%; no significant differences among sites

Salmon Growth rates (estimated from otoliths)



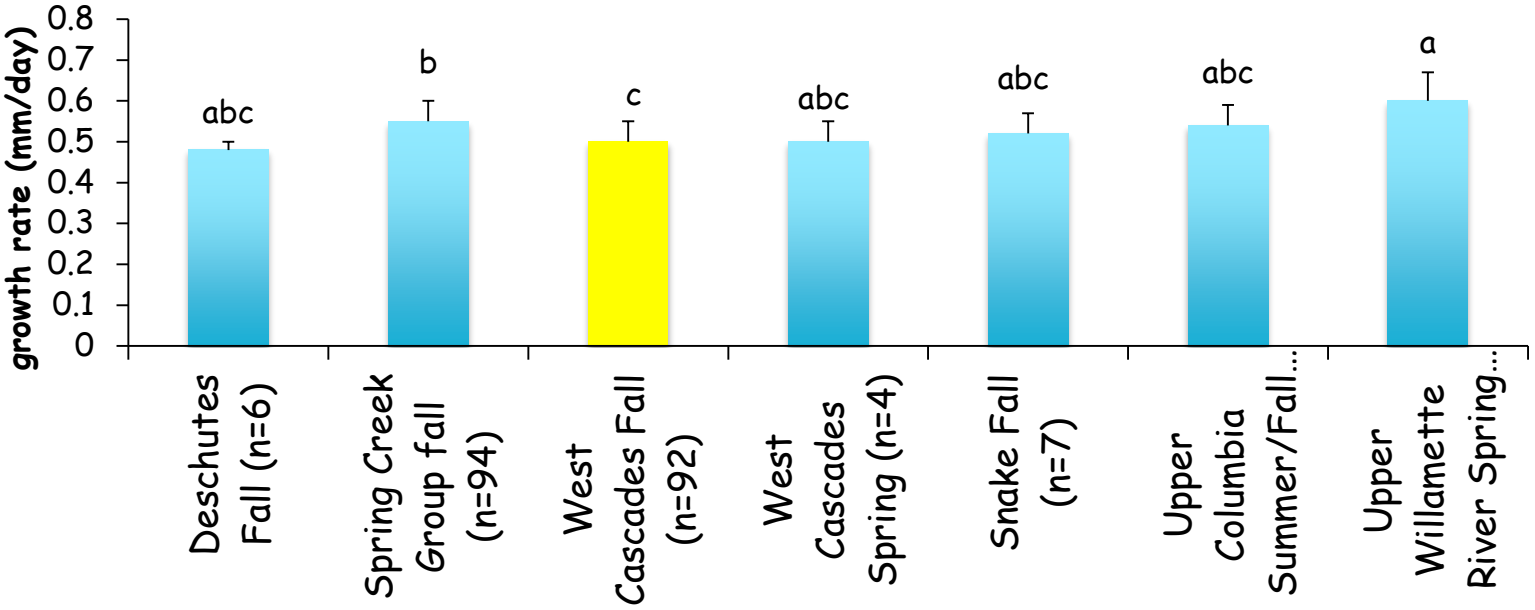
Lower growth rates in fish from Reach C sites

Salmon Growth rates by origin and stock



Growth rates lower in unmarked fish and in West Cascades fall chinook

Most Reach C fish from these groups



Ecosystem Monitoring Results

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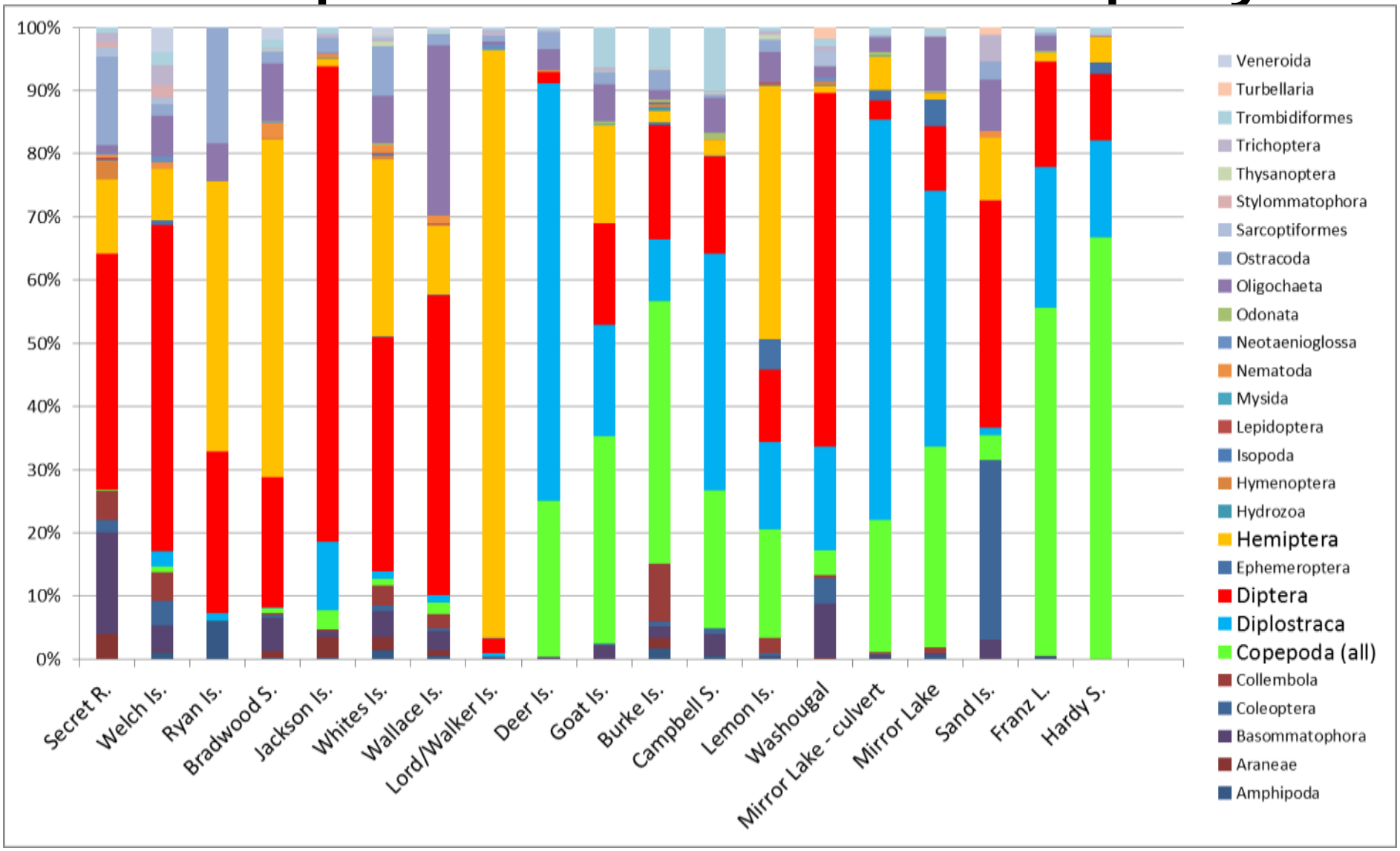
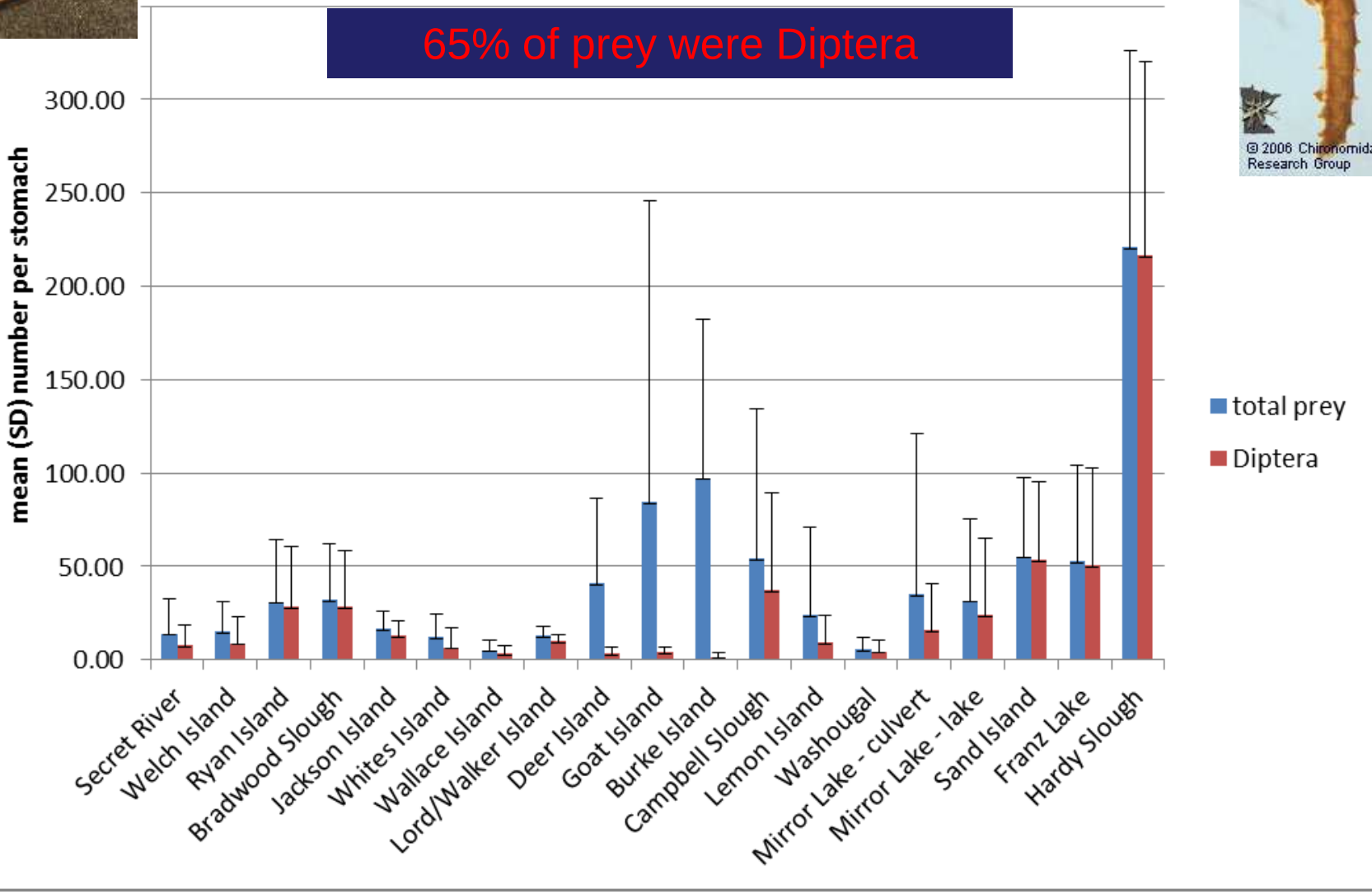
- Variety of prey but consistent preference by Chinook for Dipteran prey; found at highest densities in nearshore emergent vegetation

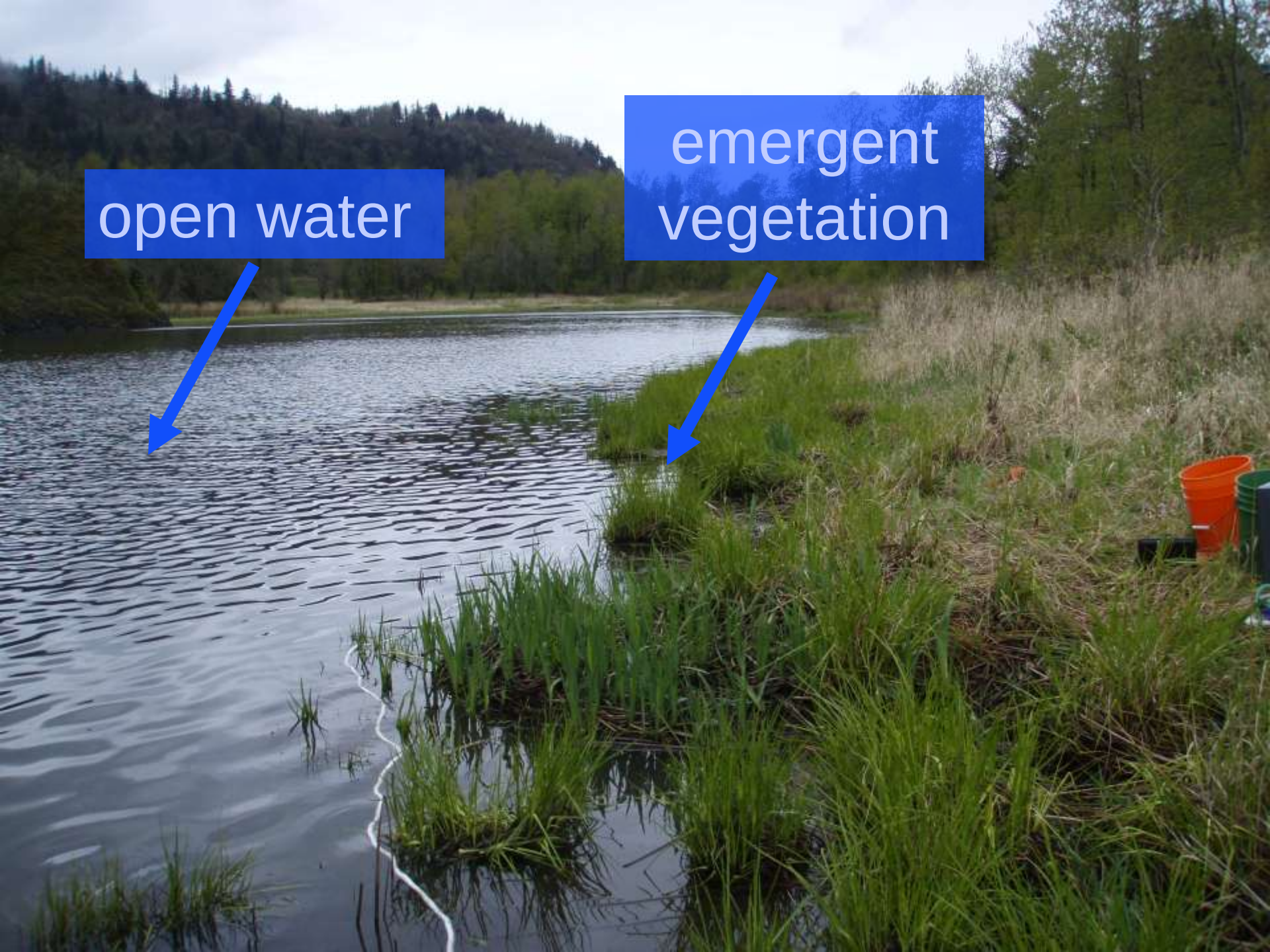
Composition of available prey



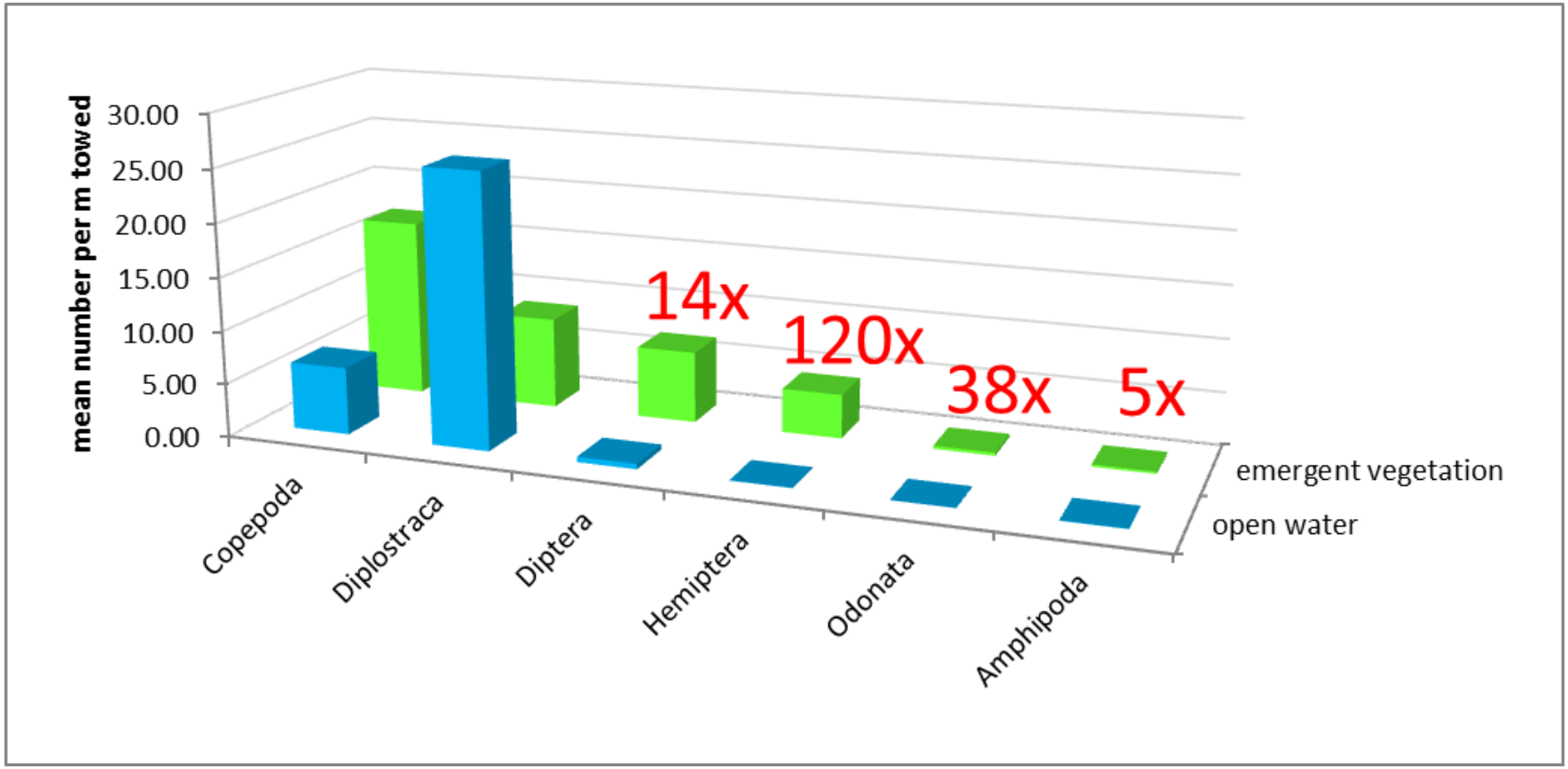
Consumed prey: Diptera

65% of prey were Diptera




open water
emergent vegetation

Source of preferred prey items?
Emergent vegetation



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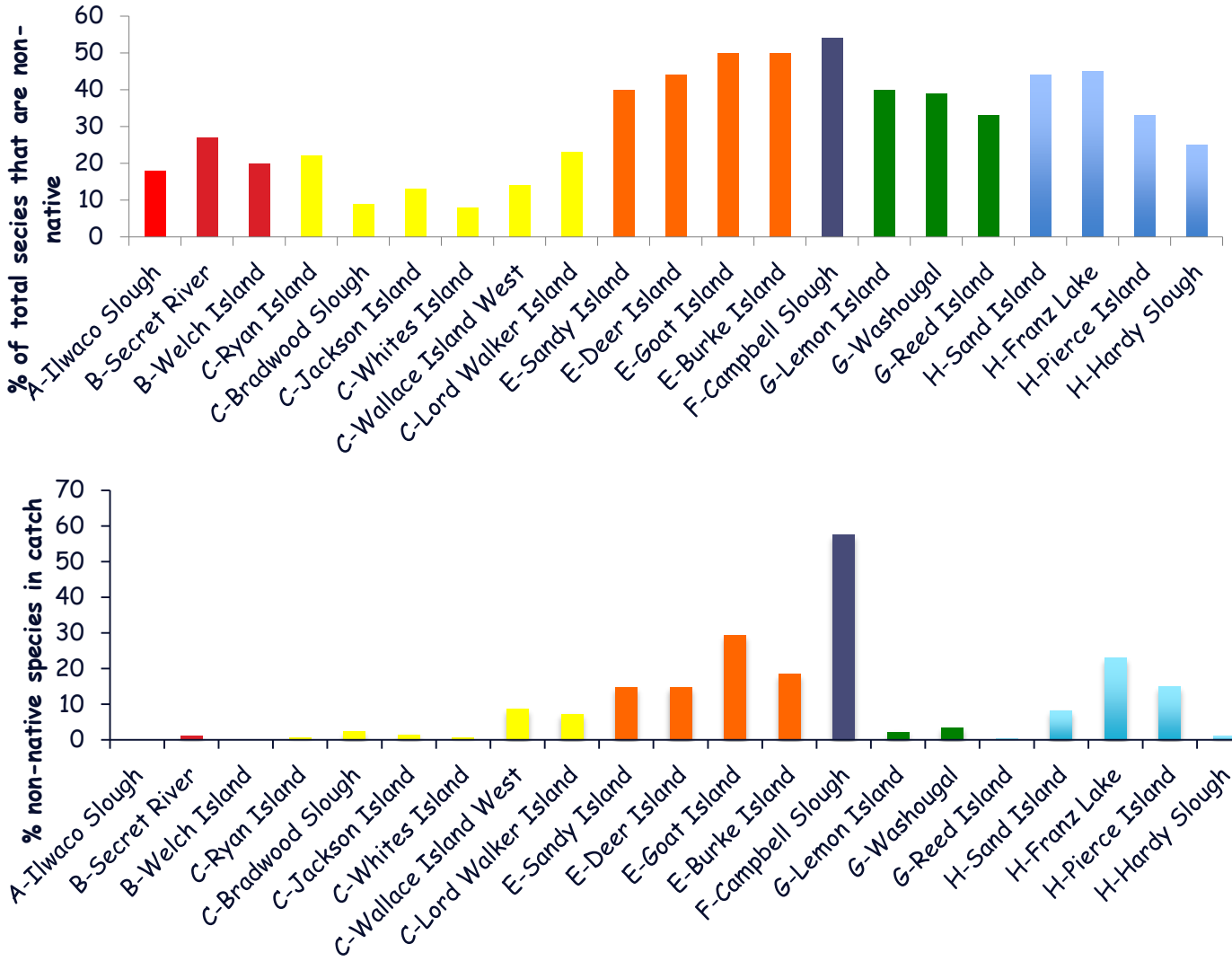
- Evidence of human activity even at relatively undisturbed sites
  - Non-native species, especially in Reaches E-H

Non-native species



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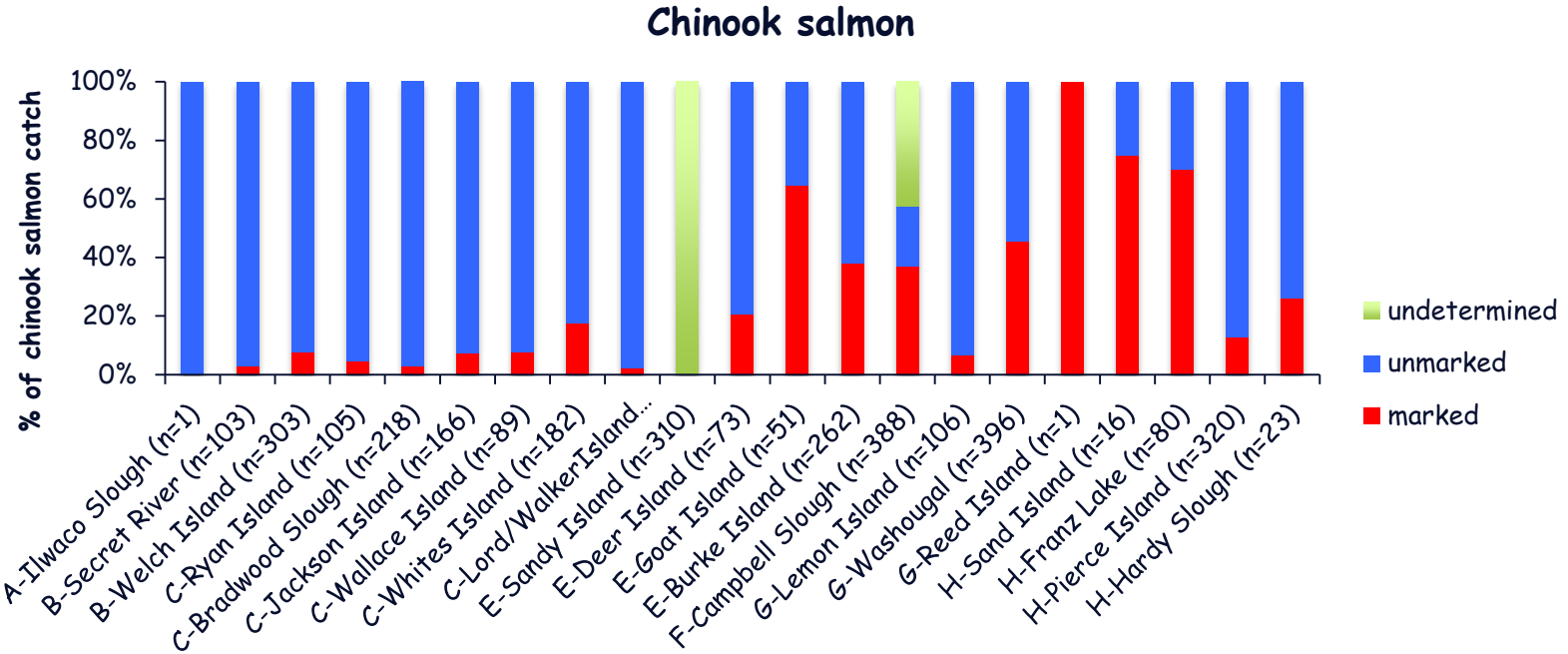
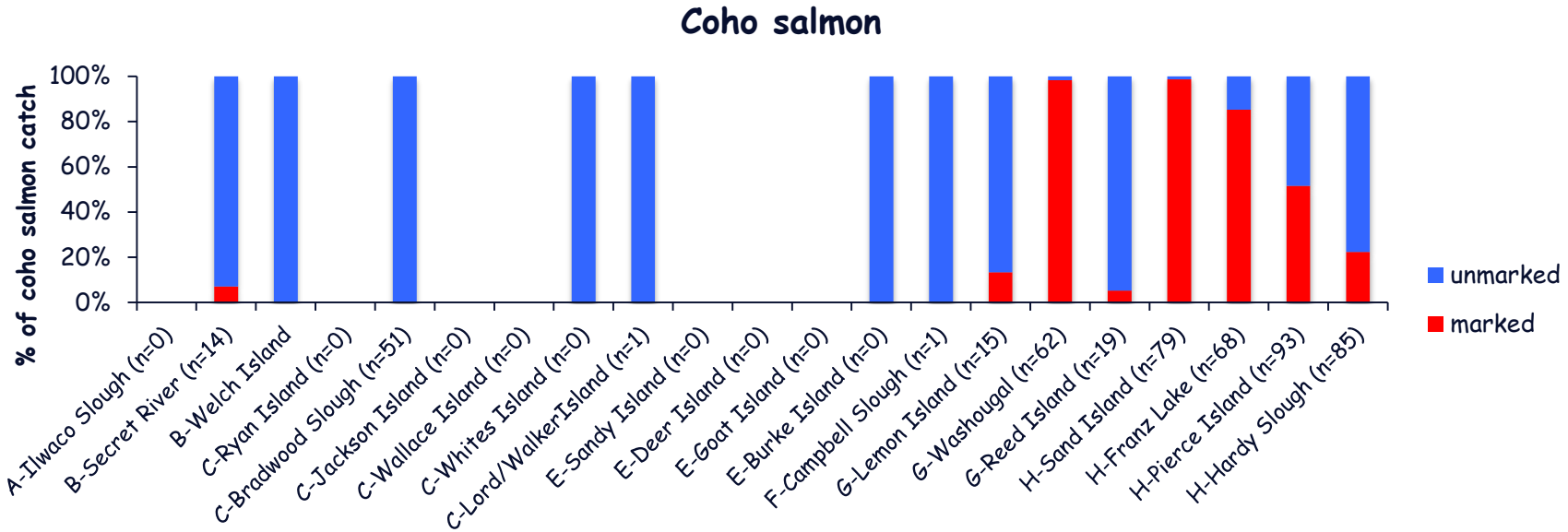
  - Dominance of hatchery fish, especially in Reaches E-H

Marked vs. Unmarked Chinook and Coho Salmon





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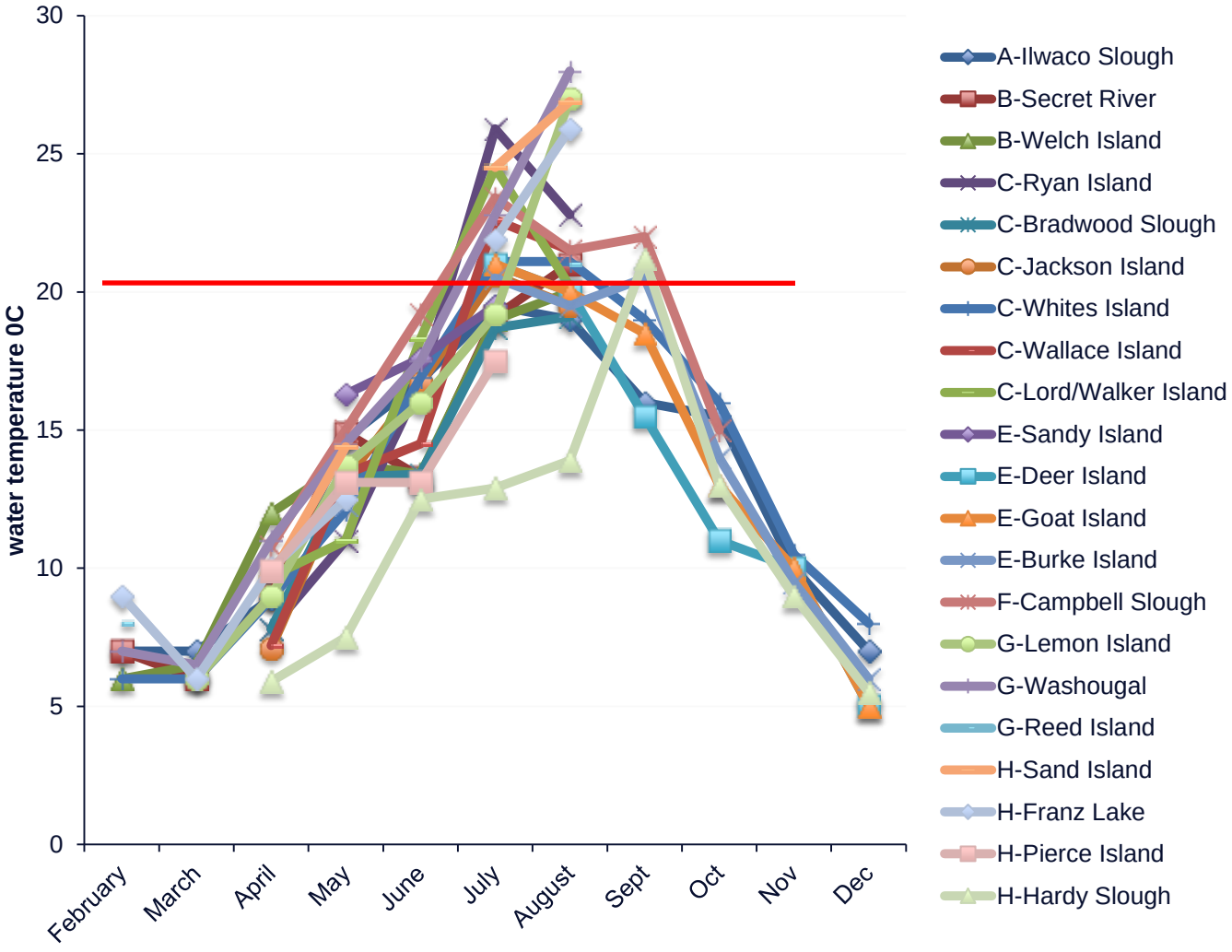
  - High summer water temperatures at most sites

Water Temperature



The typical water temperature range from 5-10°C in February-April, rising to 20-25°C in August, then declining to 5-10°C by Nov/Dec .

Lower temperatures at Hardy Slough, Pierce Island, Bradwood Slough

Water temperatures above preferred range for salmon in July and August

Ecosystem Monitoring Results

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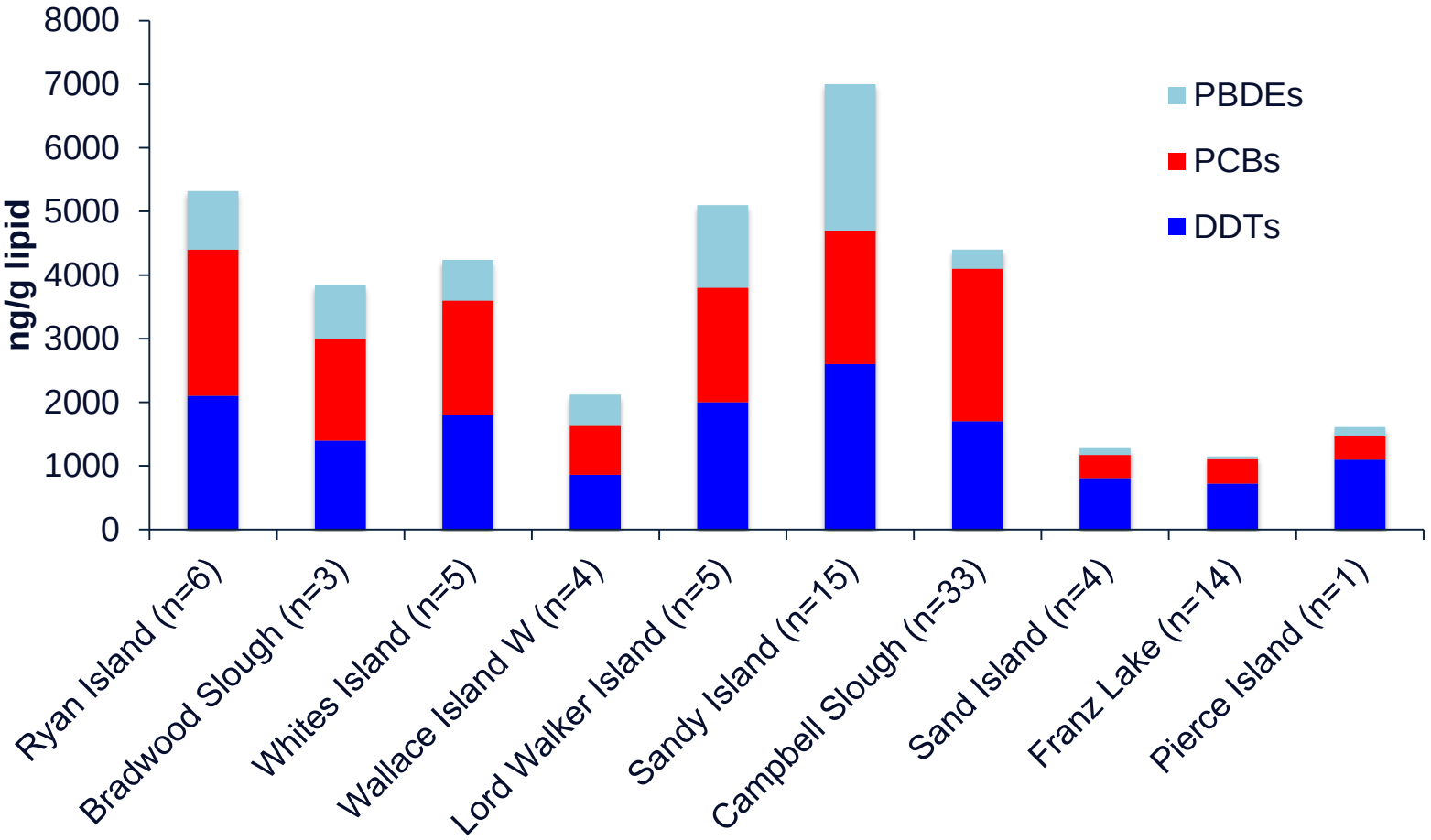
  - Non-native species, especially in Reaches F-H
  - Dominance of hatchery fish, especially in Reaches F-H
  - High summer water temperatures at most sites
  - Chemical contaminants, especially below Portland/Vancouver

Persistent organic pollutants in Chinook salmon



PCBs: 21% of samples at or above estimated toxic effects threshold
PBDEs: 30% of samples at or above estimated toxic effects threshold

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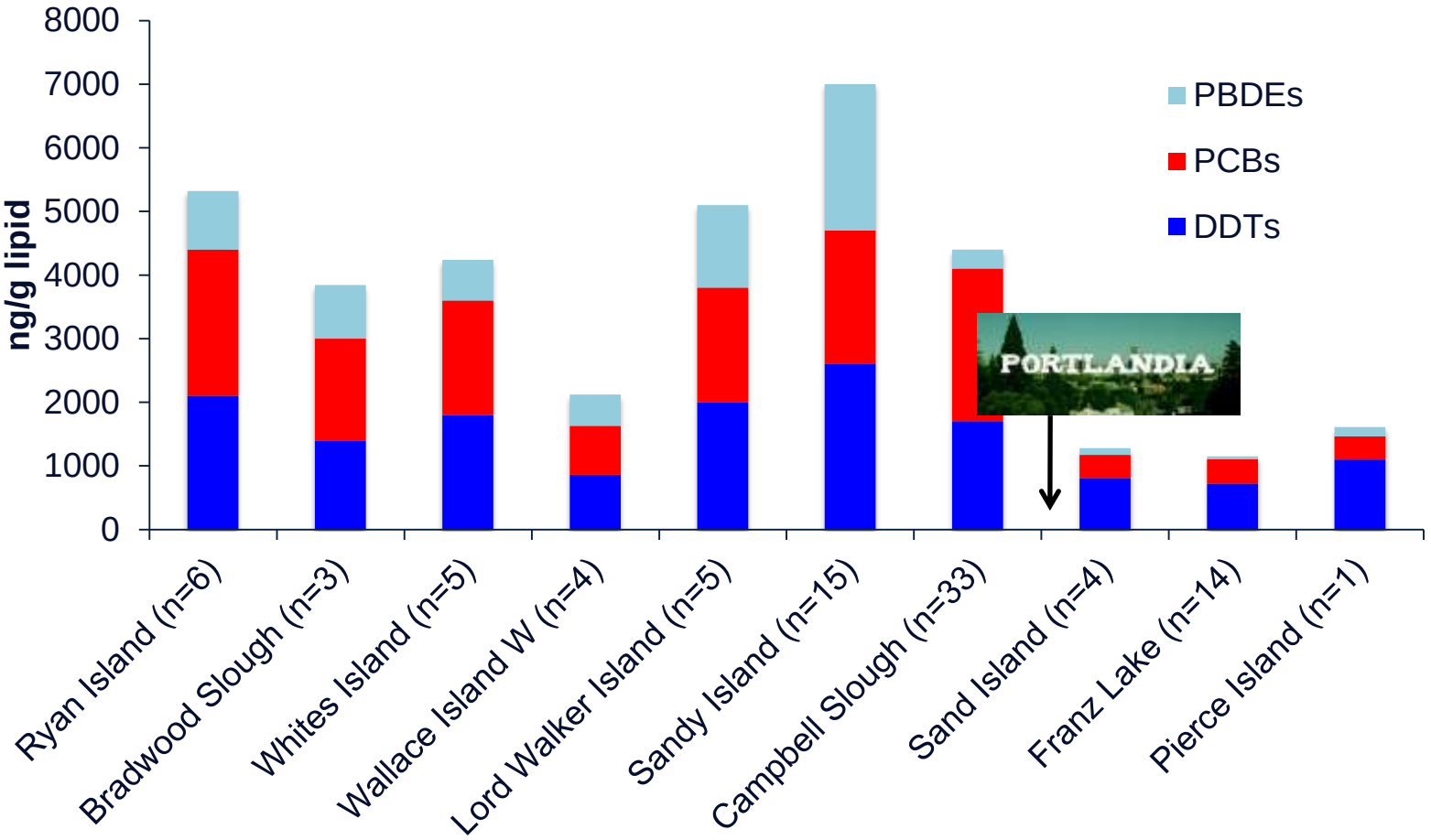

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Summary of Findings

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- Multiple salmon species and stocks with distinctive patterns of occurrence by reach
- Variety of prey but consistent preference by Chinook for Dipteran prey; found at highest densities in nearshore emergent vegetation
- Evidence of human activity even at relatively undisturbed sites
  - Non-native species, especially in Reaches E-H
  - Dominance of hatchery fish, especially in Reaches E-H
  - High summer water temperatures at most sites
  - Chemical contaminants, especially below Portland/Vancouver

Management Implications

- Tidal freshwater emergent marsh habitats are important to multiple salmon stocks
- Quality of these habitats would be maintained and improved by activities that will
  - Preserve nearshore emergent vegetation
  - Moderate summer temperatures
  - Reduce the spread of non-native species
  - Reduce chemical contamination