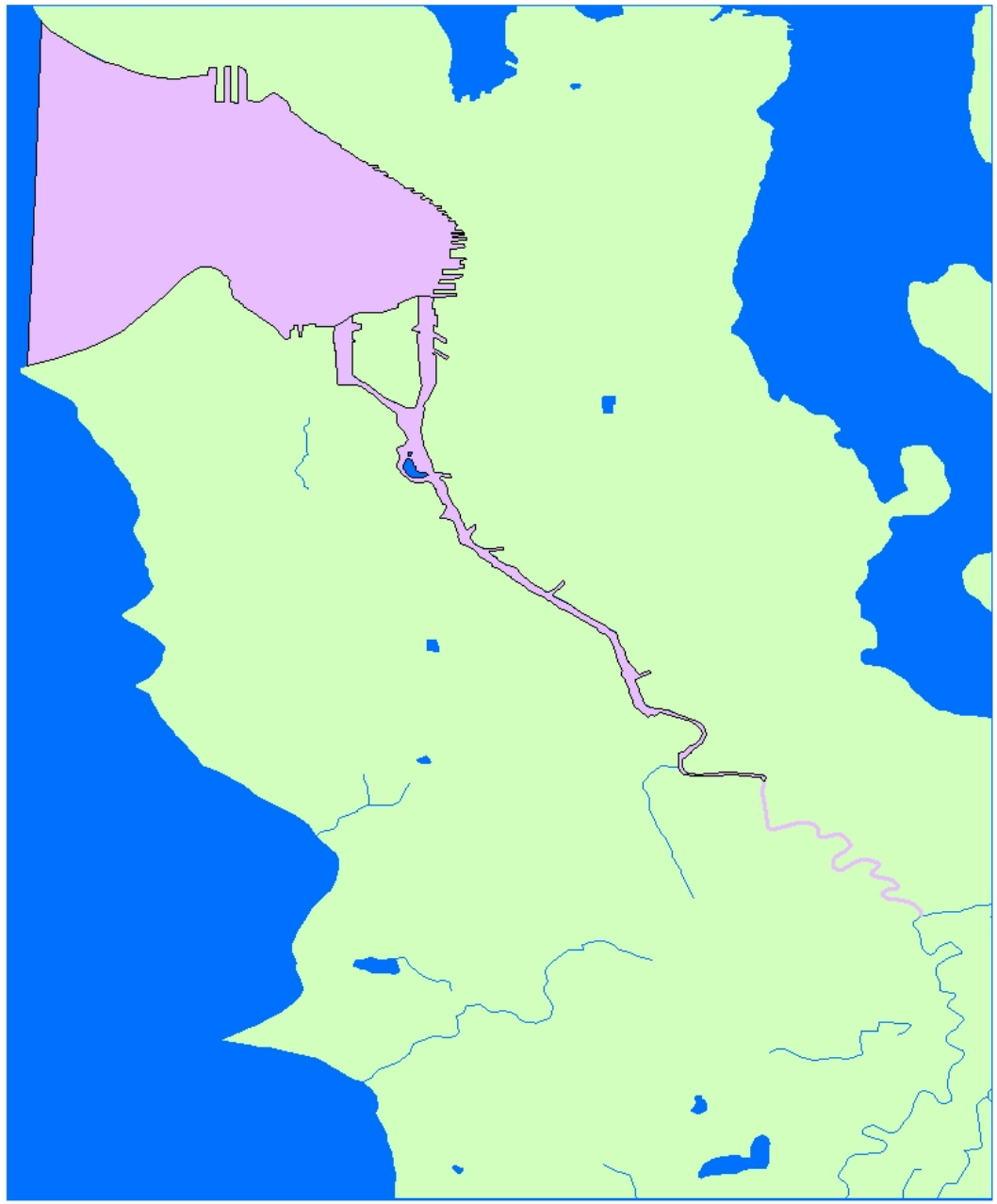
Development of Fish* Consumption Rates for Use in MTCA Surface Water Cleanup Level Equations at Sites Impacting the Duwamish River and Elliott Bay

Why are we here?

- Ecology cleanup sites releasing contaminants to the Duwamish River and Elliott Bay
- Fish may accumulate site-related contaminants, and humans may be exposed to these contaminants via fish consumption
- Asians & Pacific Islanders (API)s reside and fish in the vicinity of the Duwamish
- API fish consumption rates are greater than the MTCA fish consumption rate used to compute surface water cleanup levels (SWCUL)s
- Ecology wishes to adopt a higher fish consumption rate to develop SWCULs protective of APIs who might consume fish from the Duwamish and Elliott Bay



Presentation outline

- Process for modifying MTCA exposure parameters
- MTCA surface water cleanup level equation
- Rationale for Ecology concerns about current rate's protectiveness
- Fish consumption surveys and the API study
- API study utilization, issues and responses
- Next steps

Process for modifying MTCA exposure parameters

- MTCA [WAC 173-340-708(10)] allows for modification of certain exposure parameters on a site-specific basis when necessary to protect human health.
- Modification of some exposure parameters, including fish consumption rates, requires consultation with EPA, WADOH and the SAB. [WAC 173-340-702 (15)].

MTCA surface water cleanup levels

$$CUL\ (\mu g/L) = \frac{(RISK \times ABW \times AT \times UCF1 \times UCF2)}{CPF \times BCF \times \mathbf{FCR} \times \mathbf{FDF} \times ED}$$

Where:

CPF = Carcinogenic Potency Factor

RISK = Acceptable cancer risk level

ABW = Average body weight, (70 kg)

AT = Averaging time (75 years)

UCF1 = Unit conversion factor (1,000 ug/mg)

UCF2 = Unit conversion factor (1,000 grams/liter)

BCF = Bioconcentration factor (liters/kilogram)

FCR = Fish consumption rate (54 grams/day)

FDF = Fish diet fraction (0.5) (unitless)

ED = Exposure duration (30 years)

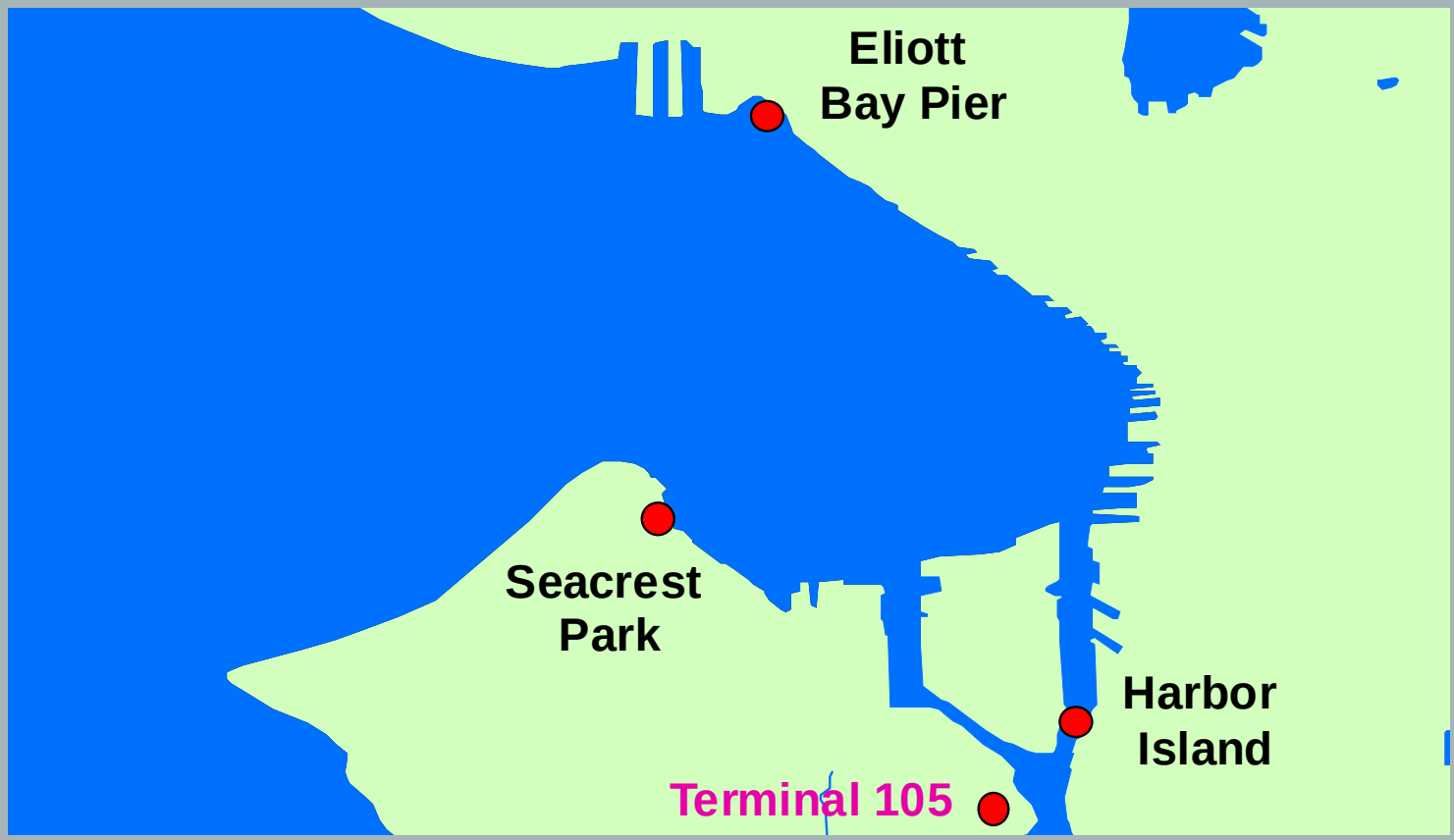
Site-related contamination may affect surface water quality

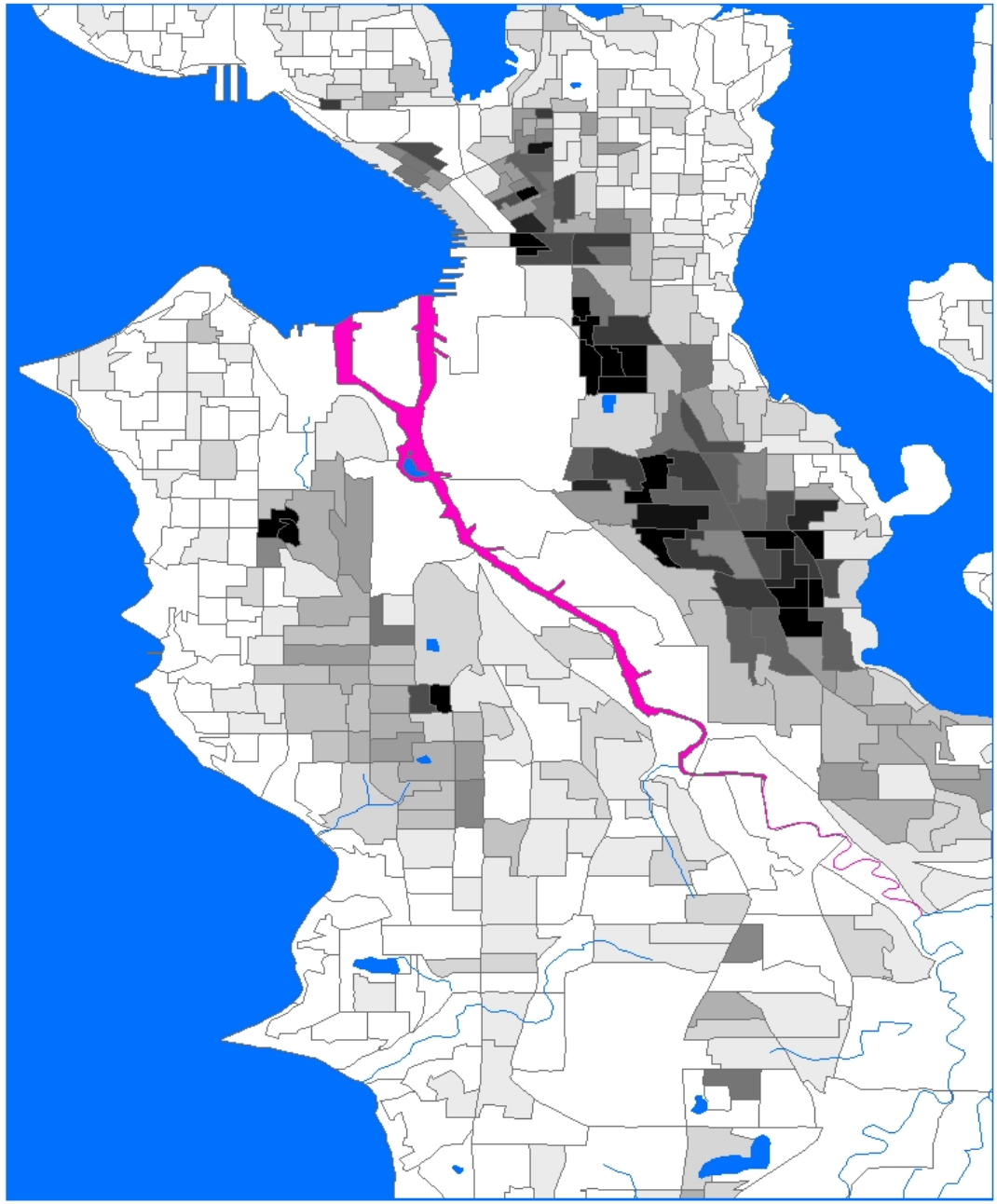
- Site-related contaminants may discharge to surface water via groundwater, runoff or direct application to sediments
- Humans consuming fish that have accumulated contaminants are at risk

MTCA consumption rate protectiveness concerns

- APIs consume seafood from the Duwamish area and Elliott Bay (King County, 1998; Landolt et al. 1987; McCallum, 1985)
- A large number of APIs reside in King County, including areas bordering the Duwamish River (e.g., Georgetown; 2000 U.S. Census)
- 1999 API fish consumption study indicates APIs consume more fish than Ecology's default rate

King County Seafood Consumption Survey, 1998




No. of Asians and Pacific Islanders per square mile
0 - 400
400 - 800
800 - 1200
1200 - 1600
1600 - 2000
2000 - 2400
2400 - 2800
2800 - 3200
3200 - 3600
3600 - 4200
4200 - 4600
4600 – 5000
5000 - 5400
5400+

Creel vs. Personal Interview Surveys

- Creel: Interviews done in the field, catch inspected
- Personal interview: Interviews done in a non-field setting

Creel surveys

- Individuals interviewed a function of who's fishing, can over sample frequent anglers
- Months and hours covered
- Language barriers and fear of authorities are an issue when interacting with ethnic minorities.
- Interviews only collect information between the time an individual starts fishing and time of interview
- Interviewee can feel burdened
- Quantification of portion size difficult

Personal interview surveys

- Can select a random sample of the group to be surveyed
- Can assess fish consumption throughout the year
- Some uncertainty associated with recall that can be quantified with repeat interviews
- Can be done in environments that are comfortable for ethnic minority interviewees
- Use of models and other aids to quantify portion size easier than for creel surveys

Strengths of the EPA 1999 API study

- Interviewers trained
- Survey pilot tested and refined
- Interviewees randomly selected
- Interviewers were trusted members of the ethnic communities being surveyed

API total fish consumption, EPA 1999

Statistic	Grams fish & shellfish consumed per day
10%	30
25%	47
50%	86
75%	136
90%	246
Mean	114

Issues in developing an API consumption rate

- Representativeness of the API study
- Rate for entire API group vs. specific ethnicities
- Fraction of consumption assumed to be affected by the site
- Adjustment of consumption rates to an uncooked basis

Representativeness

Does the API study provide a reasonable basis for deriving a fish consumption rate for the API community?

- Participant selection
- Ethnic groups included in survey vs. ethnic groups comprising the API community
- Fractions of ethnic groups tabulated in census vs. survey

Representativeness: participant selection

- Interviewees selected randomly from API community group rosters and from volunteer lists obtained by public outreach
- To avoid bias, the study was advertised as a "Dietary Habits Study for Asian Pacific Islanders"
- All individuals interviewed were1st or 2nd generation APIs residing in King County
- Interviewee set not biased high or low with regards to fish consumption by fish consumers

Representativeness: Ethnic groups in census vs. survey

- 202 individuals in 10 ethnic groups surveyed in API study.
- Groups surveyed represent 83.6% of the King County API population (U.S. Census, 2000)
- Uncertainty
- Unknown bias
- Best available data

Rate for entire API group vs. specific ethnicities

- Small numbers of individuals surveyed per ethnic group
- These low numbers preclude developing upper percentile consumption rates for individual ethnicities
- Upper percentile rate to be developed using overall data set

Fraction of consumption affected by the source

- **API study recorded fish source:**
  - Grocery stores
  - Restaurants
  - Harvest within King County
  - Harvest outside of King County
- **Source fraction recorded for:**
  - Anadromous species
  - Bottom feeding fish
  - Pelagic fish
  - Shellfish
  - Freshwater fish

Rejected source-fraction options

- Total consumption rate:
  - Overly conservative
  - Fish from groceries & restaurants not likely affected by site-related contaminants
- Fraction harvested anywhere: Harvest area too large to all be affected by site contamination

Proposed source fraction = King County harvested fraction

- Acknowledge King County is larger than the area of application.
- **However:**
  - Pollutants and fish are mobile.
  - Individuals may obtain their fish from small regions.
  - Reported King County harvest in'99 may have been lower due to perceptions that the resource was contaminated.

Washington DOH Duwamish fish consumption warnings

Source fraction incorporated on an individual basis

$$IR_{King\ County} = \sum_{i=1}^{n} (IR_i \times F_{King\ County,\ i}) \times BW$$

Where:

IR_i = ingestion rate for fish type (g/kg/day)

$F_{King\ County,\ i}$ = fraction of fish type harvested from King County

BW = body weight, kg

Use of cooked and uncooked shellfish tissue weights in the API study

- API study recorded consumption of shellfish on an uncooked and cooked basis
- Certain shellfish were steamed to facilitate removal of edible tissue for weighing

Why adjust consumption to an uncooked basis?

- Treating cooked consumption as uncooked biases consumption rates low
- Risk assessment uses contaminant concentration data from uncooked samples
- Important that concentration and consumption are both on the same basis (EFH 1997)
- Effect of different cooking techniques on weight and contaminant concentration variable

Shellfish consumption rate corrected for cooking on an individual basis

$$IR_{shellfish} = \sum_{i=1}^{n} (IR_i \times CF_i) + IR_{crab} \times CF_{crab}$$

Where:

IR_i = ingestion rate for shellfish species, g/kg/day

CF_i = cooking weight loss correction factor obtained from USDA or 1.0 if shellfish was uncooked. USDA cooking weight losses ranged from 25 to 50%. Cooking weight loss for crab available from API study data

Development of data for analysis

- Original data set used to develop King County consumer-only data set for all species harvested from King County
- Shellfish cooking weight correction factors of 0, 25%, and 50% were employed for shellfish.

Fractions of ethnic groups tabulated in census vs. API study

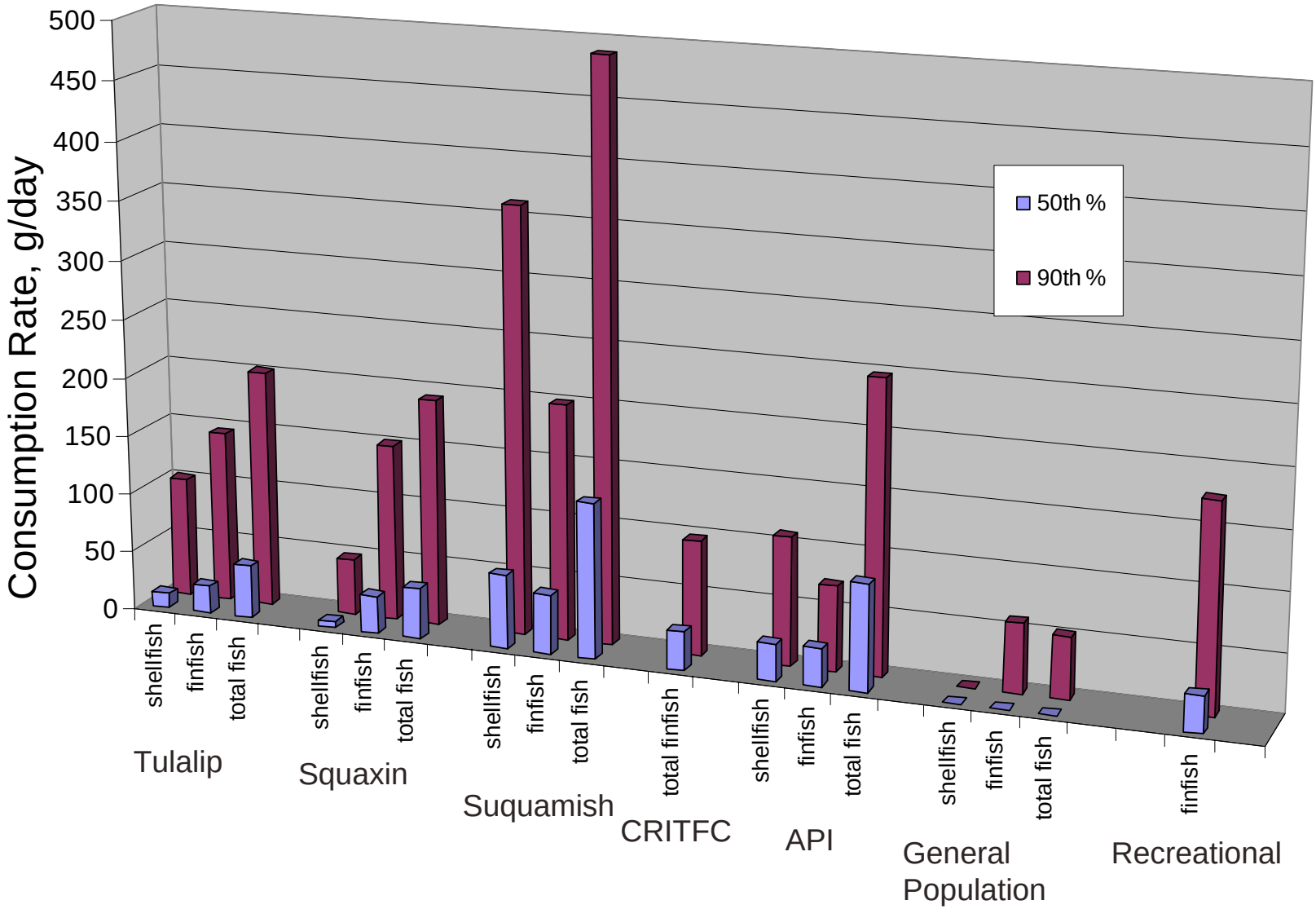
- Less well established API groups over represented in the survey relative to their proportion of the population as determined in the 1990 census
- API study used a weighting approach to correct representation to fractions observed in the census prior to computing consumption rate percentiles
- Modification of weighting approach used for this analysis
- Original statistician for the API study now believes this weighting approach may not be appropriate
- Consulting with statistician on approach
- After review new rates may be calculated

Factors considered in consumption rate development:

- Reasonable maximum exposure media contact (e.g. fish consumption rate), 95th percentile (EPA 1989)
- Fish consumers only
- Correction for cooking weight loss
- Fraction affected by source = fraction harvested from King County

Next steps

- Does the SAB concur that Ecology should proceed with this approach to derive an API fish consumption rate?
- Contract with statistician for re-analysis of API study data
- Consult with SAB and WA Dept. of Health regarding interpretation of re-analysis of study data.


Consumption Rate, g/day
500
450
400
350
300
250
200
150
100
50
0
50th %
90th %
shellfish
finfish
total fish
shellfish
finfish
total fish
shellfish
finfish
total fish
total finfish
shellfish
finfish
total fish
shellfish
finfish
total fish
finfish
Tulalip
Squaxin
Suquamish
CRITFC
API
General Population
Recreational