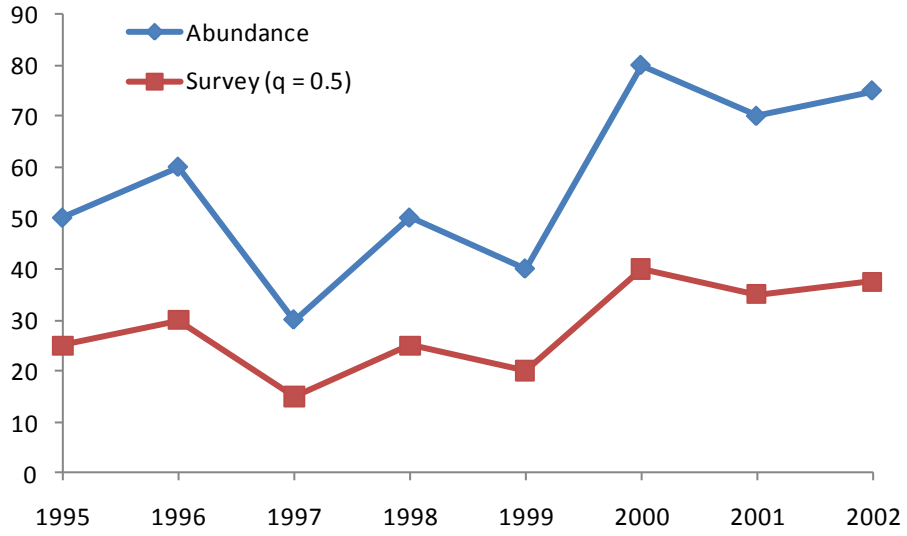
Catchability : The fraction (q) of a fish stock (N) which is caught (C) by a defined unit of the fishing effort (E).

$$CPUE = q * N$$

When q remains constant, CPUE can serve as an index of abundance



Catchability : The fraction (q) of a fish stock (N) which is caught (C) by a defined unit of the fishing effort (E).

$$CPUE = q * N$$

When q remains constant, CPUE can serve as an index of abundance

However, when q changes over time or space, then changes in CPUE can be mistaken for changes in abundance

Linear regression approaches are available for quantifying the factors affecting catchability, in order to standardize the CPUE data and better quantify relative abundance

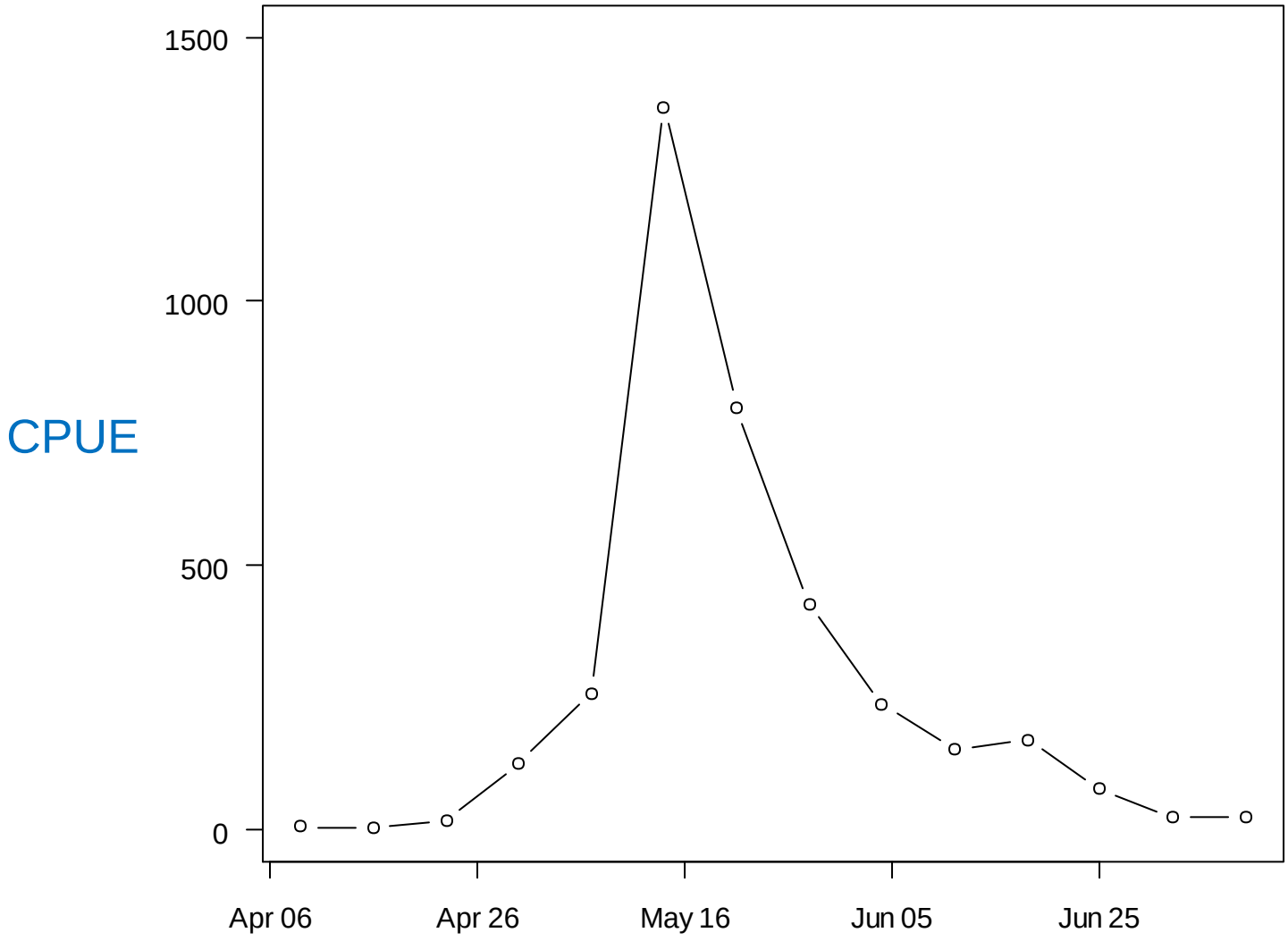
Seining surveys are a fishing process operating in a dynamic environment (rapidly changing flows), catching fish whose abundance changes over the migration season

CPUE (per haul or per week) data reflect the changes in abundance as well as changes in catchability

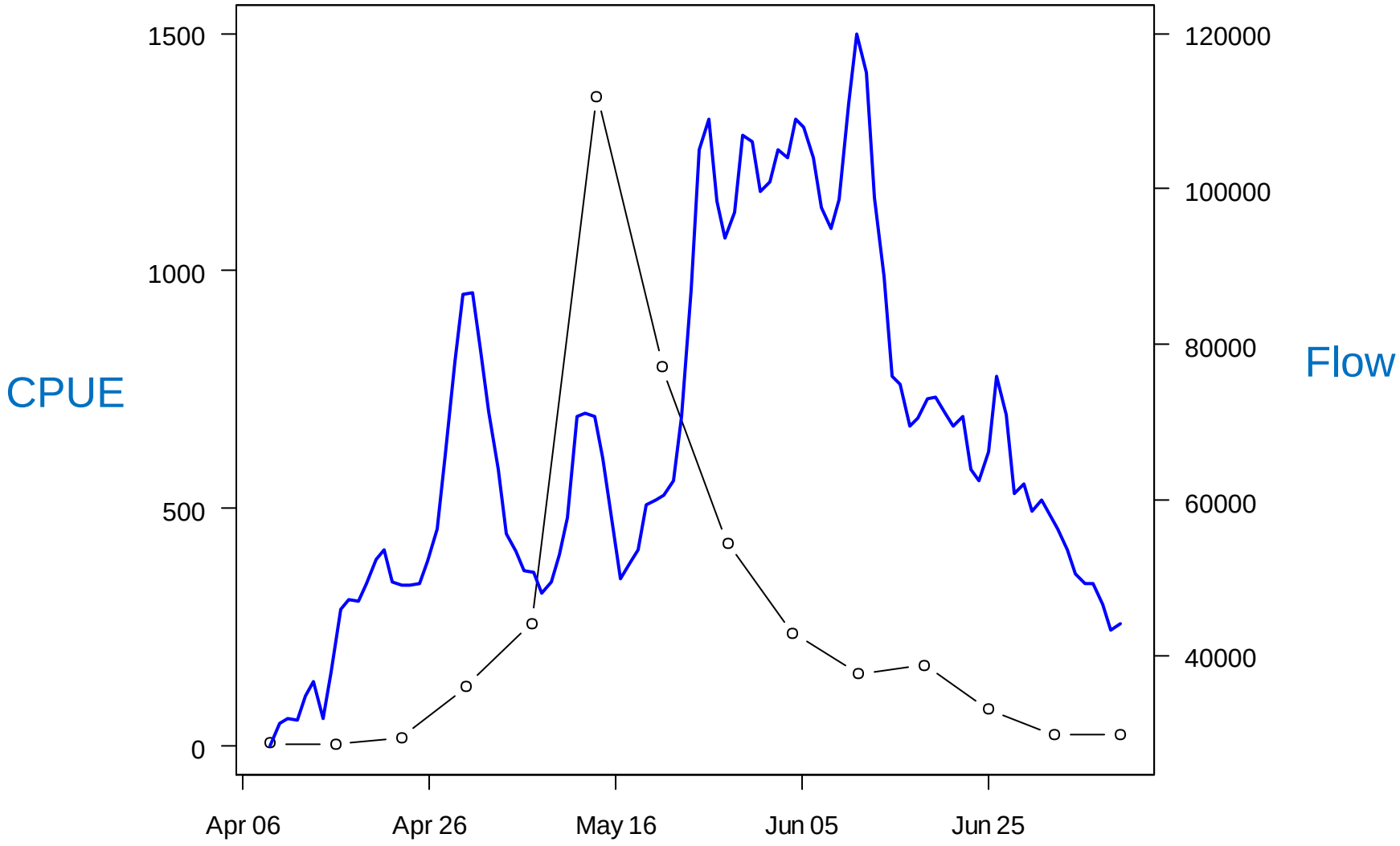
We are interested in those changes in abundance (or should be), and would like to remove the effects variable catchability from the CPUE data

$$\log_e(CPUE) = \log_e(CPUE_{ref}) + \beta_1 flow + \beta_2 Julian + \beta_3 Julian^2$$

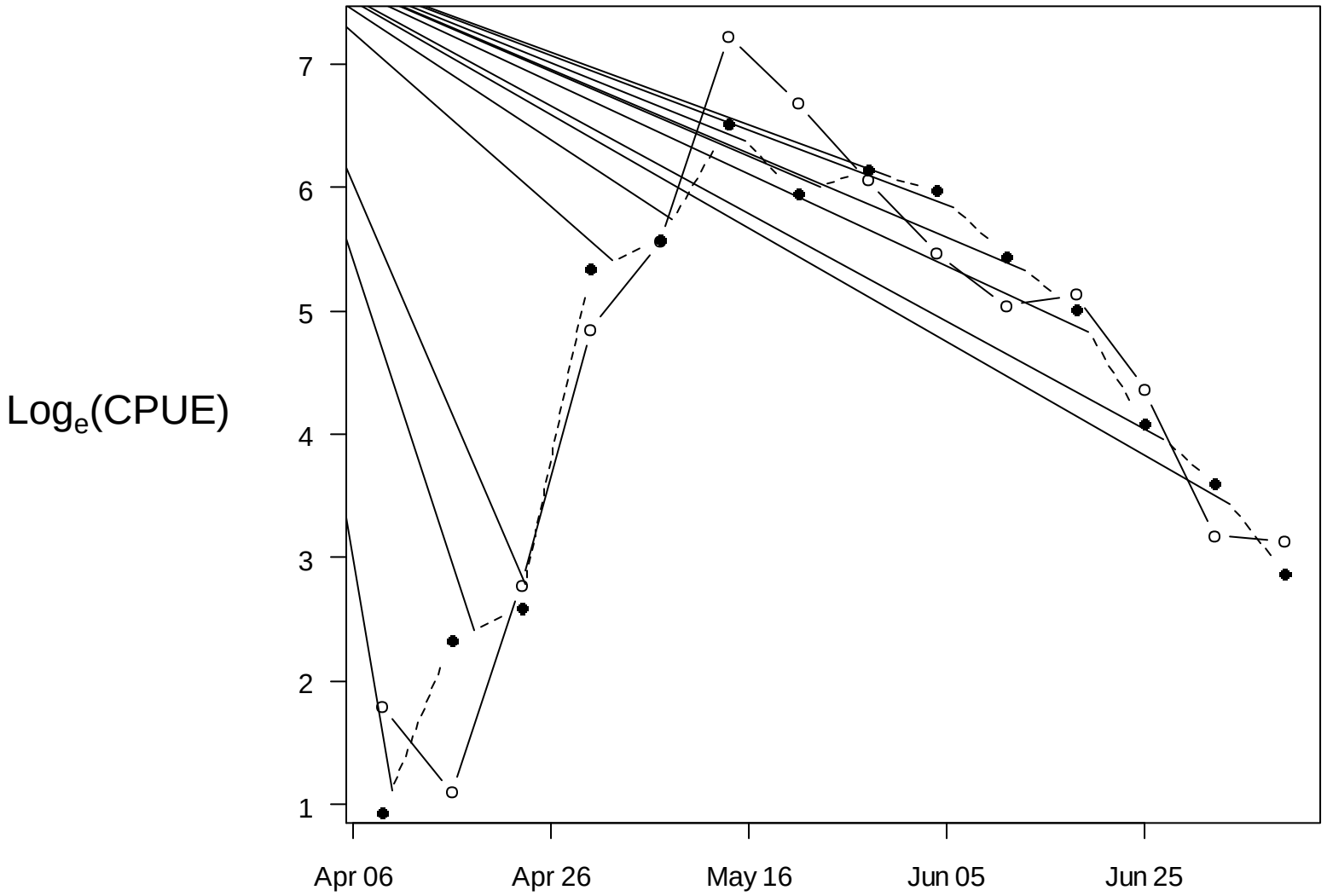
SNAKE3 2009



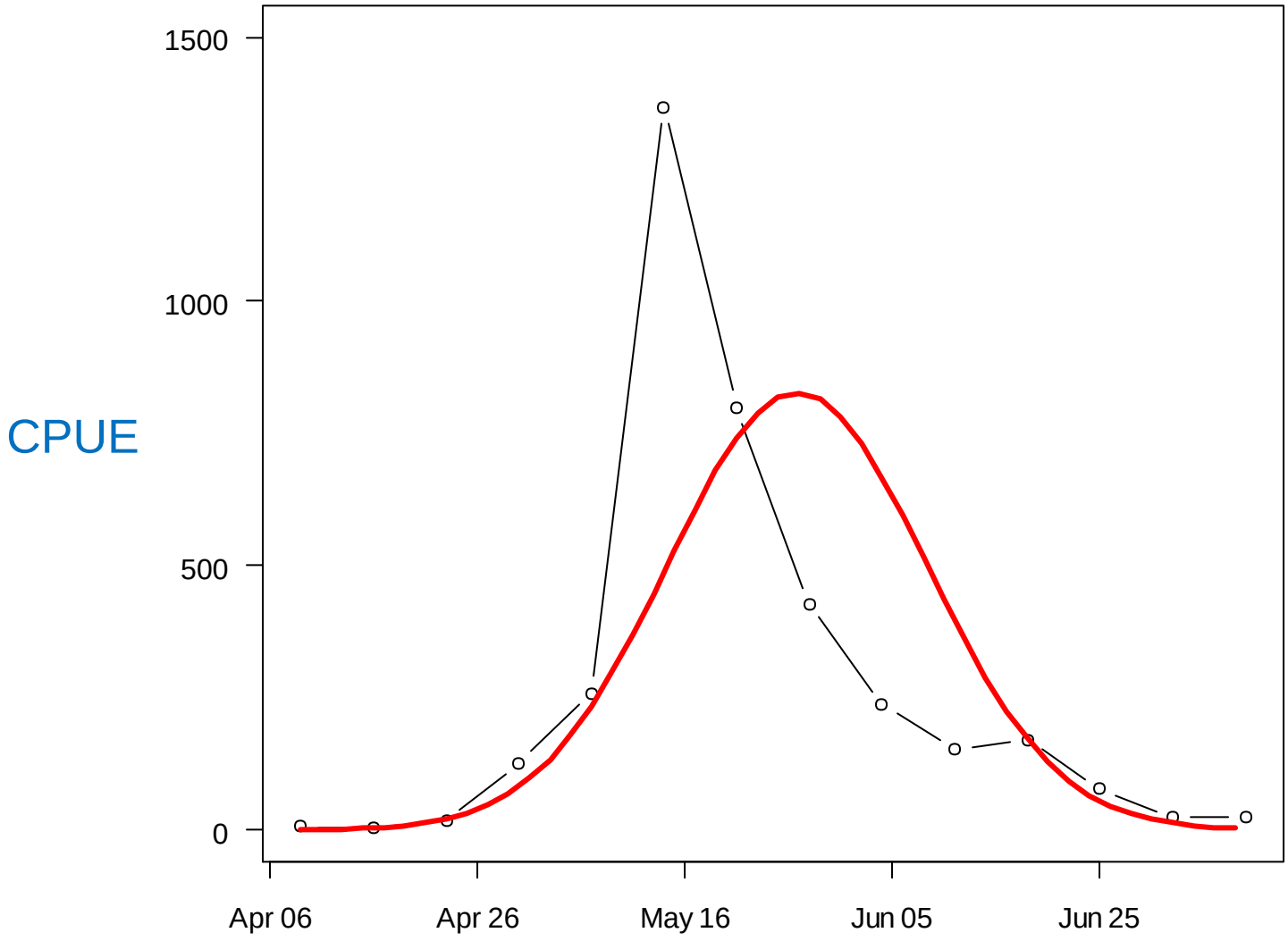
SNAKE3 2009


CPUE
Flow
1500
1000
500
0
120000
100000
80000
60000
40000
Apr 06
Apr 26
May 16
Jun 05
Jun 25

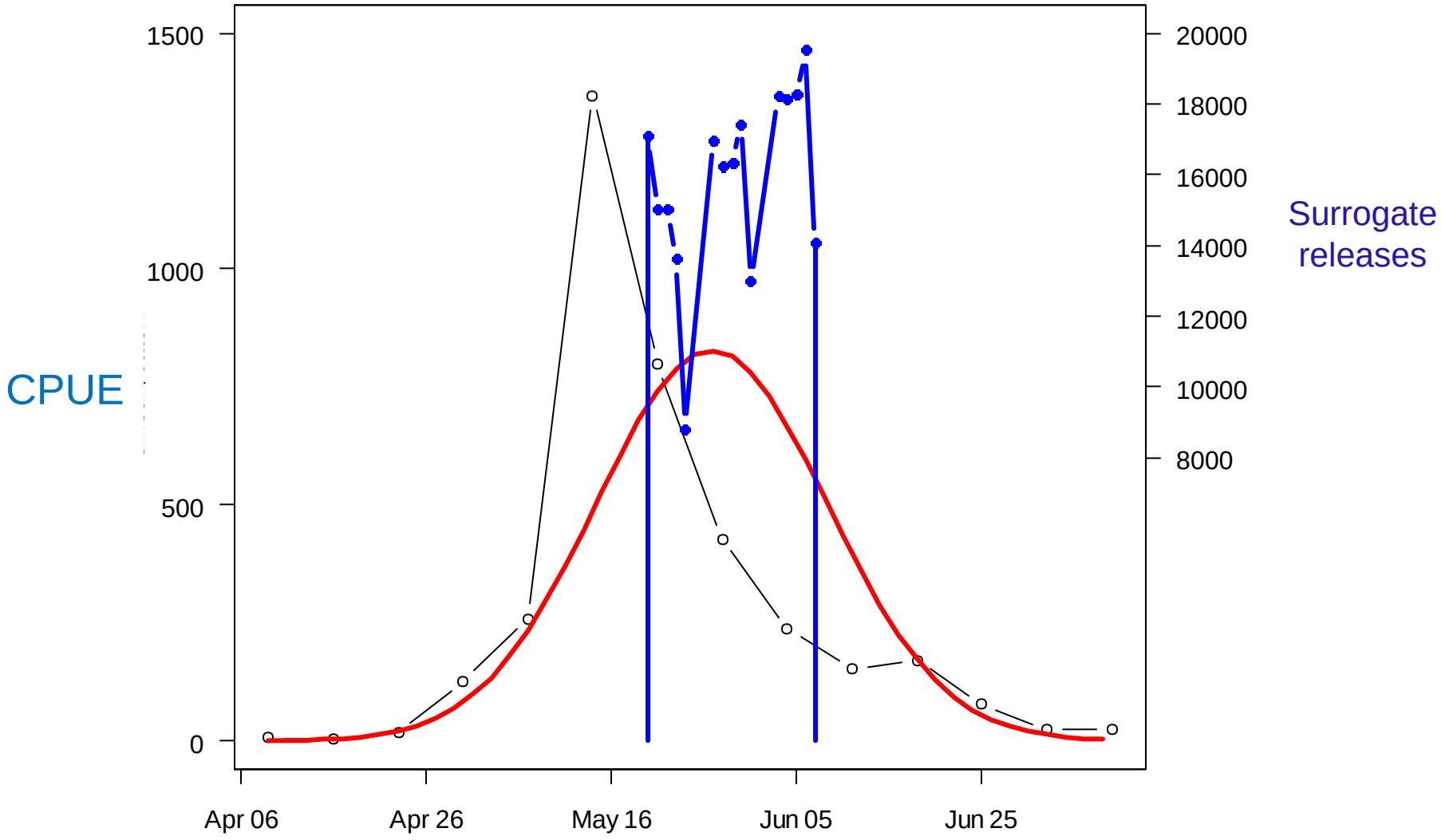
SNAKE3 2009



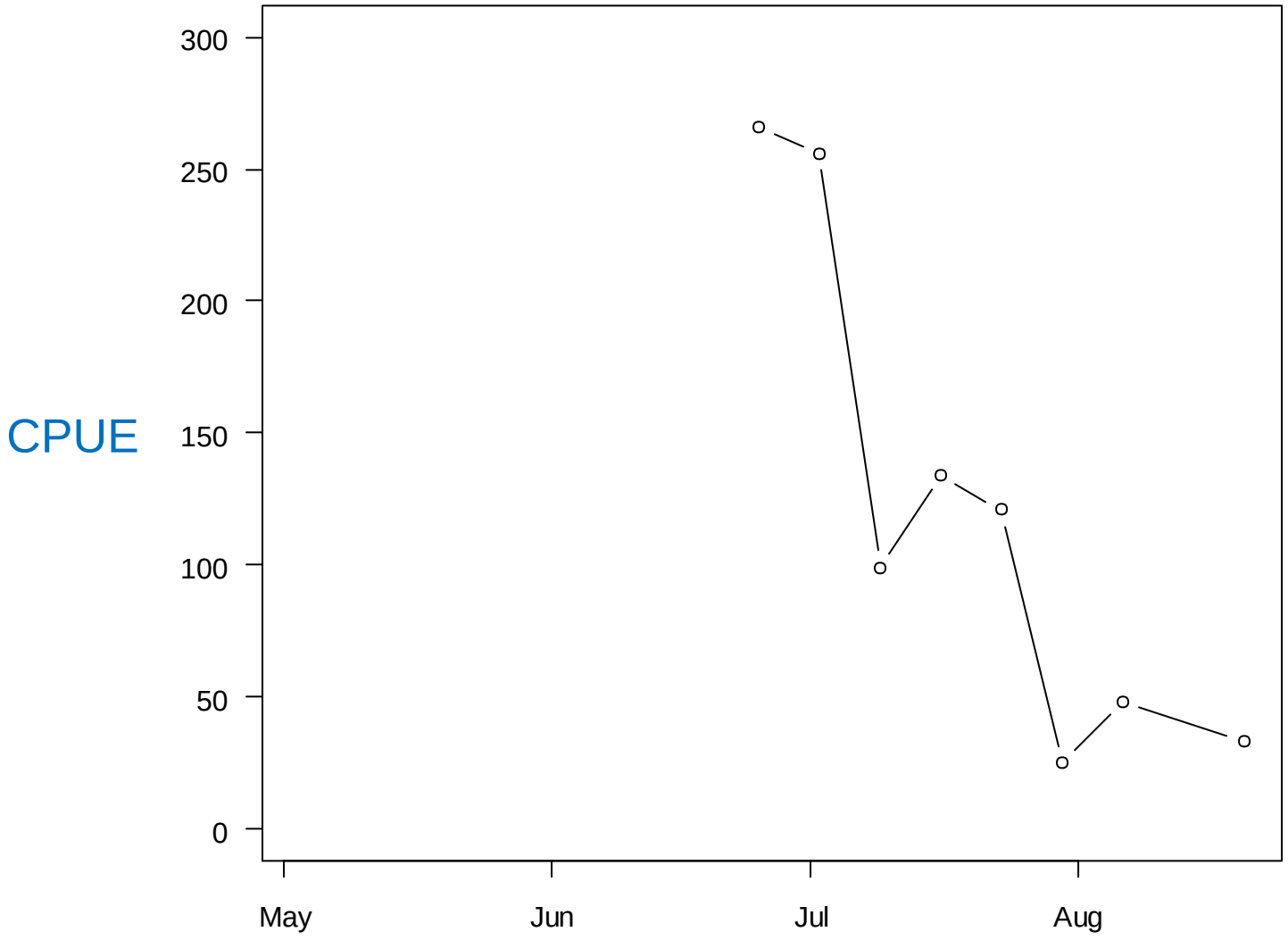
SNAKE3 2009



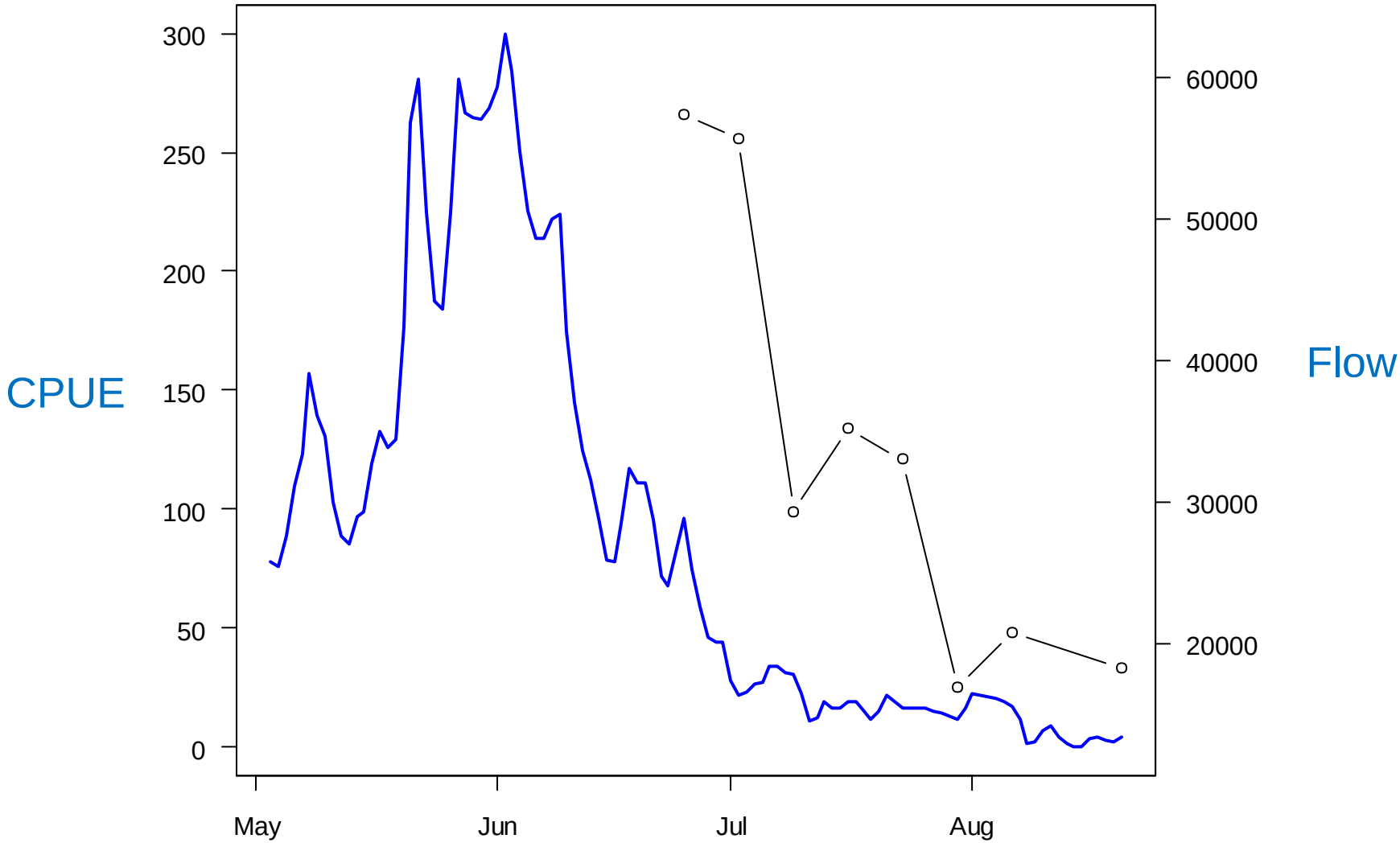
SNAKE3 2009


CPUE
1500
1000
500
0
20000
18000
16000
14000
12000
10000
8000
Surrogate releases
Apr 06
Apr 26
May 16
Jun 05
Jun 25

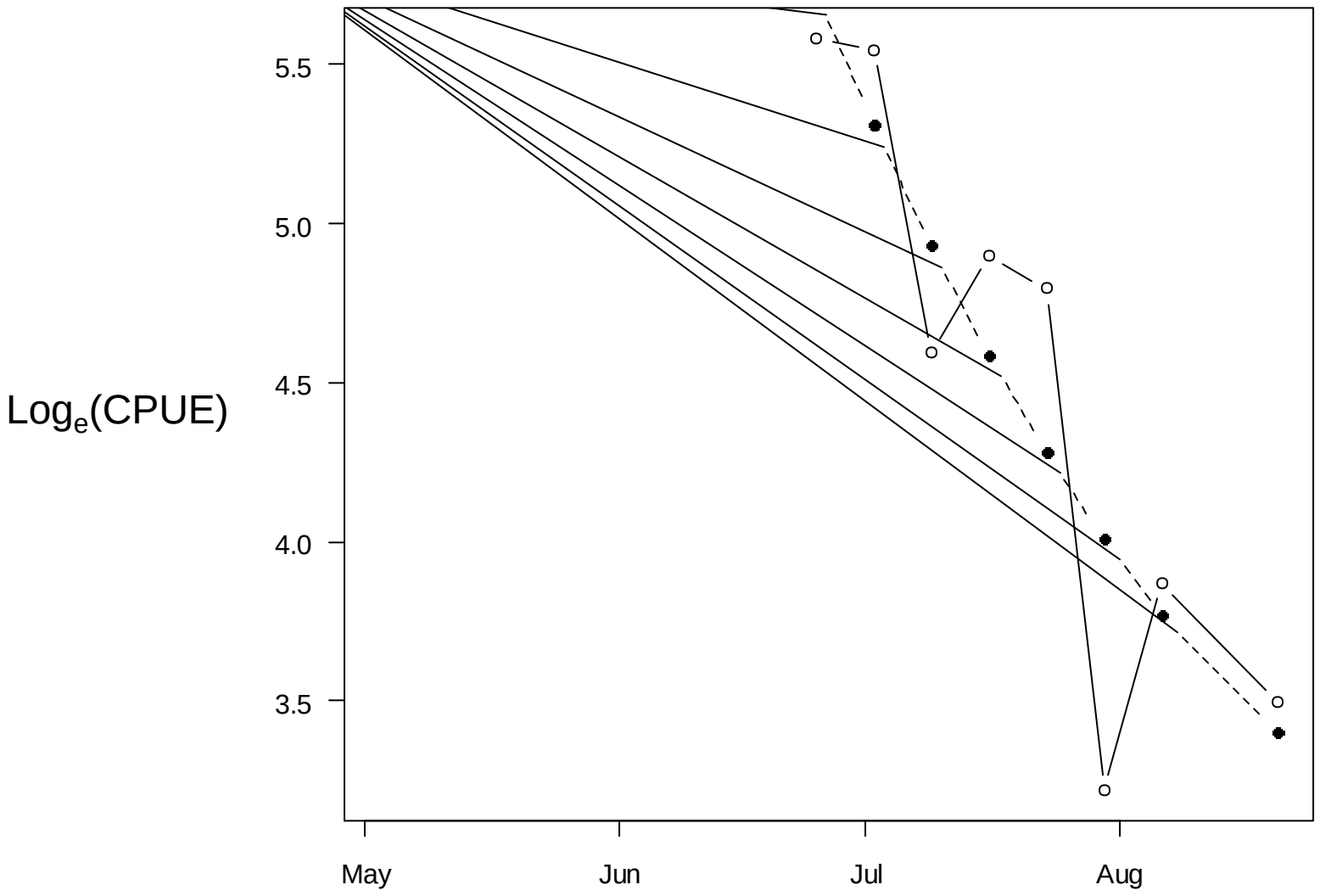
Clearwater 2009



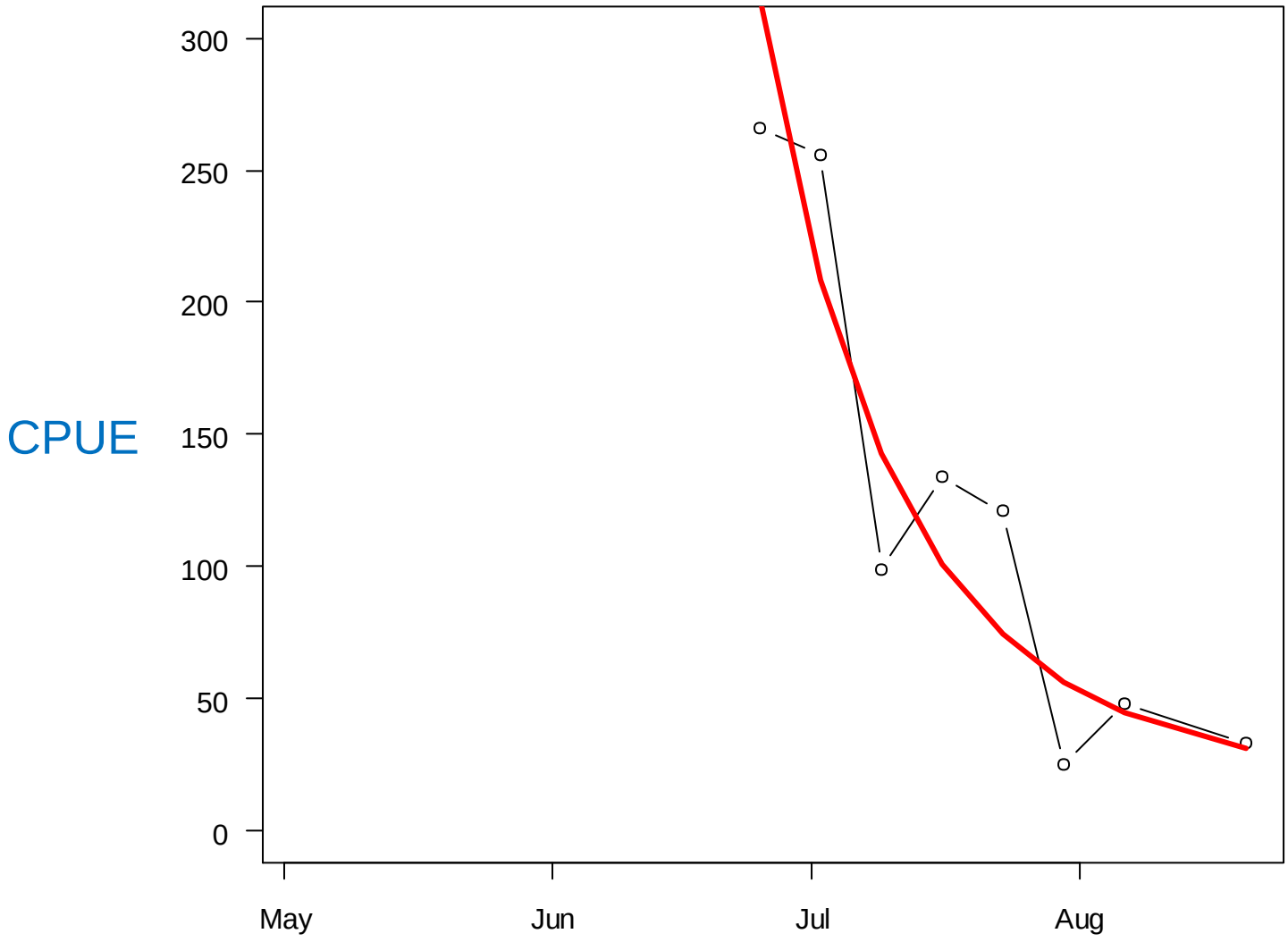
Clearwater 2009



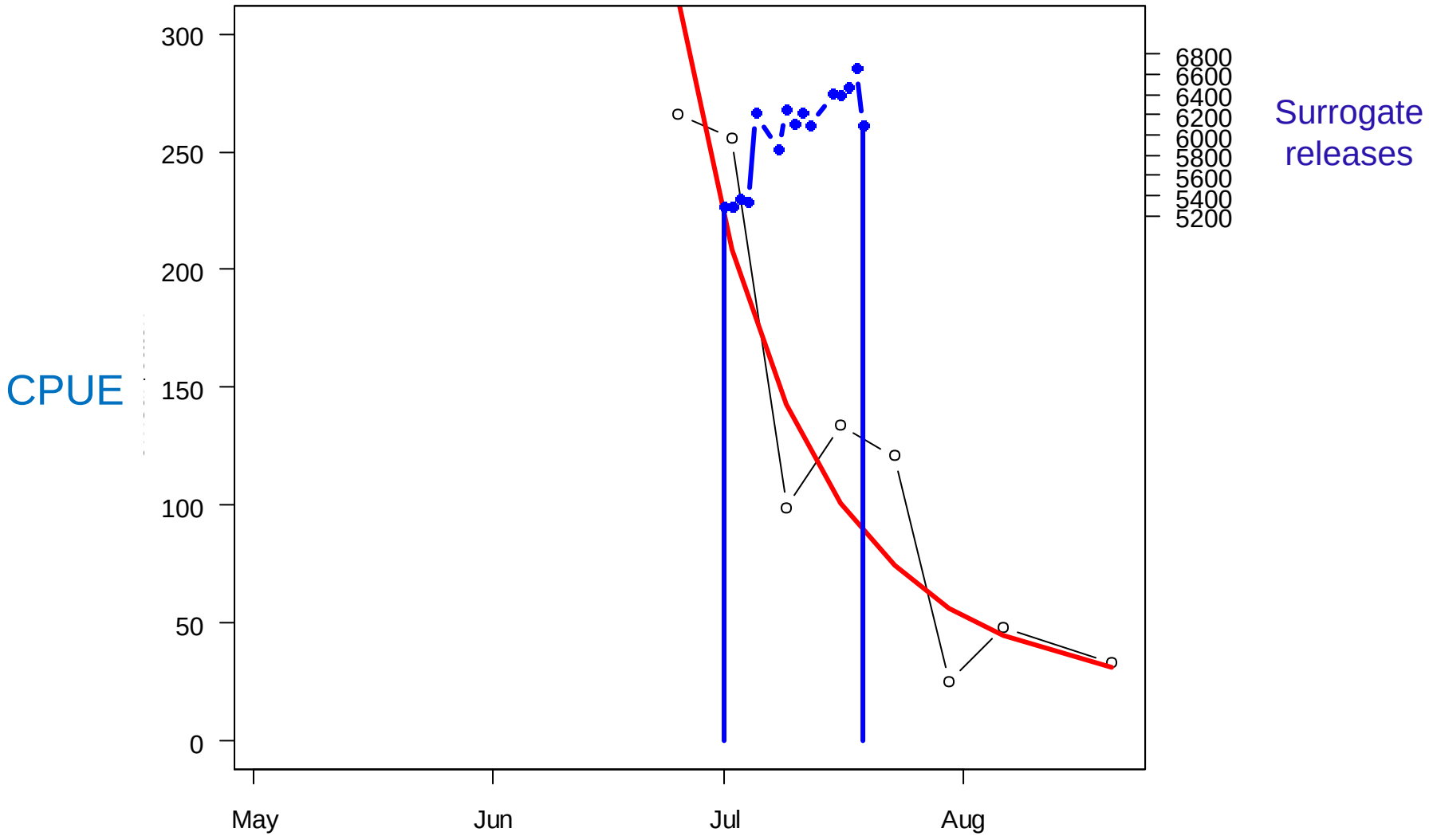
Clearwater 2009



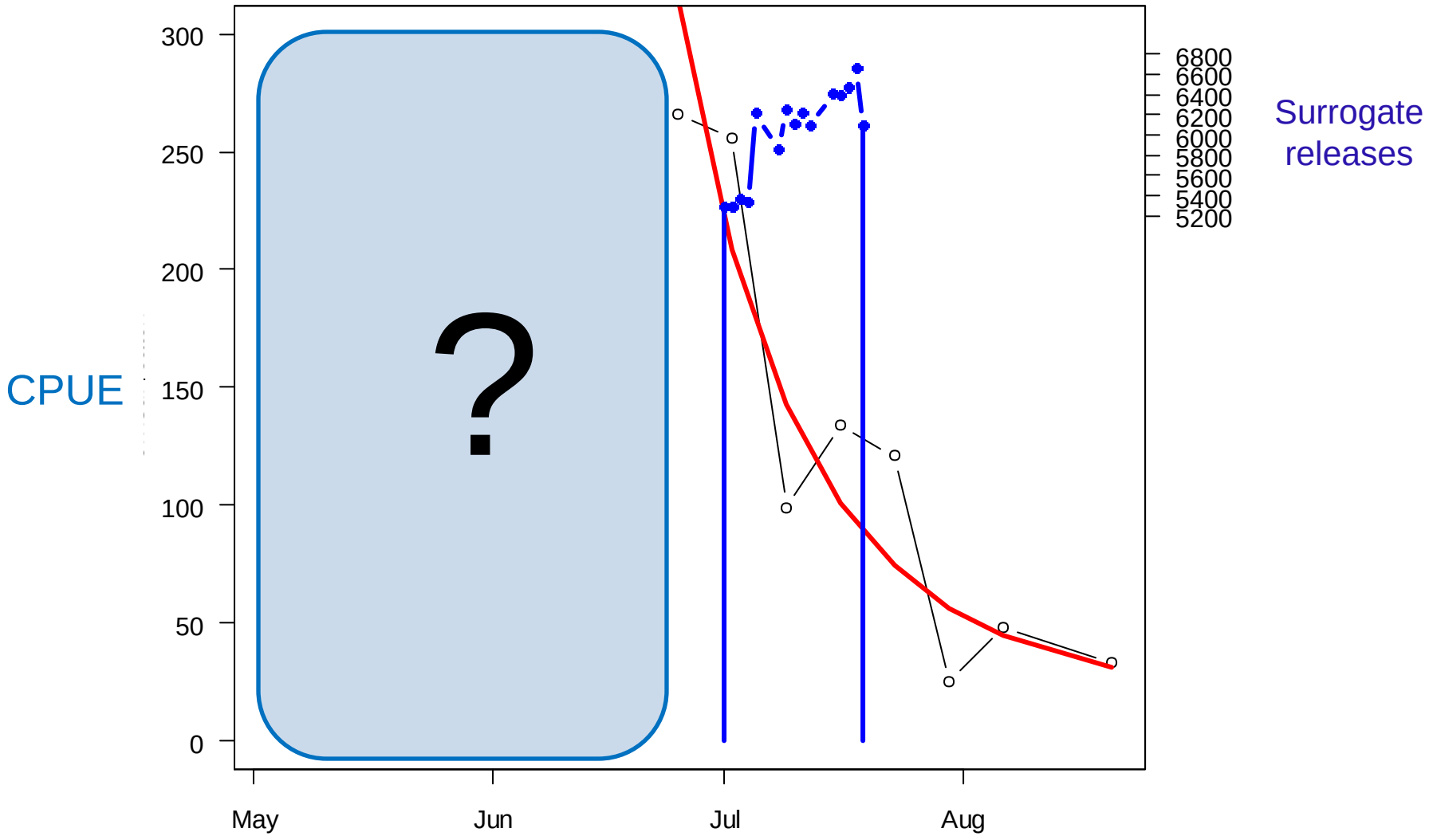
Clearwater 2009



Clearwater 2009

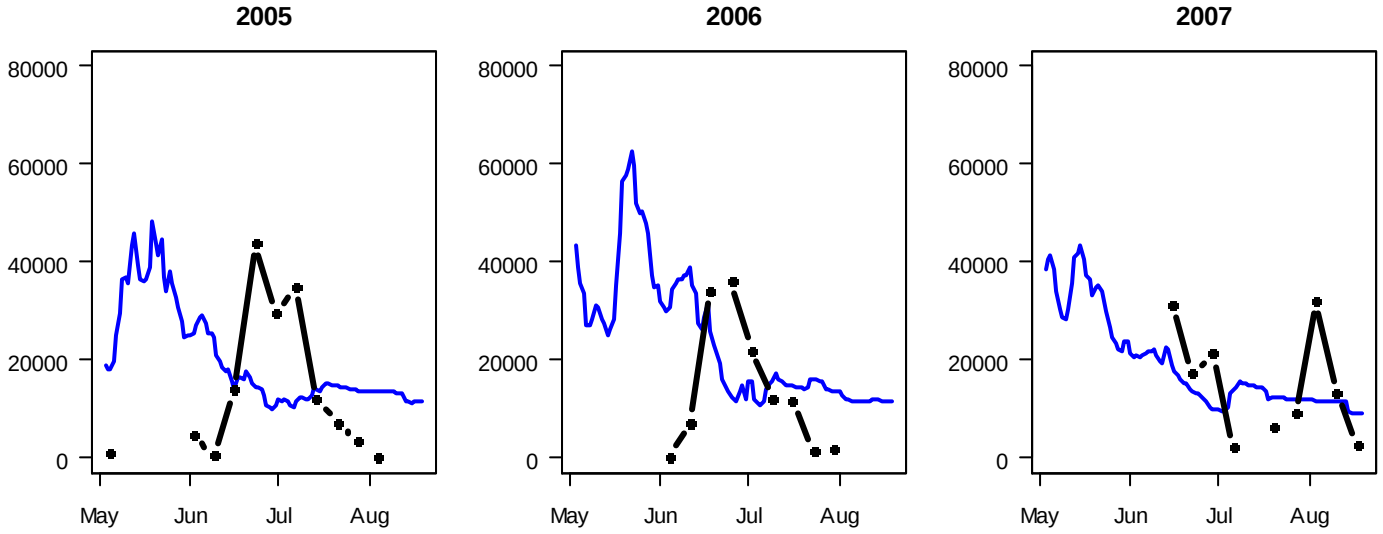


Clearwater 2009

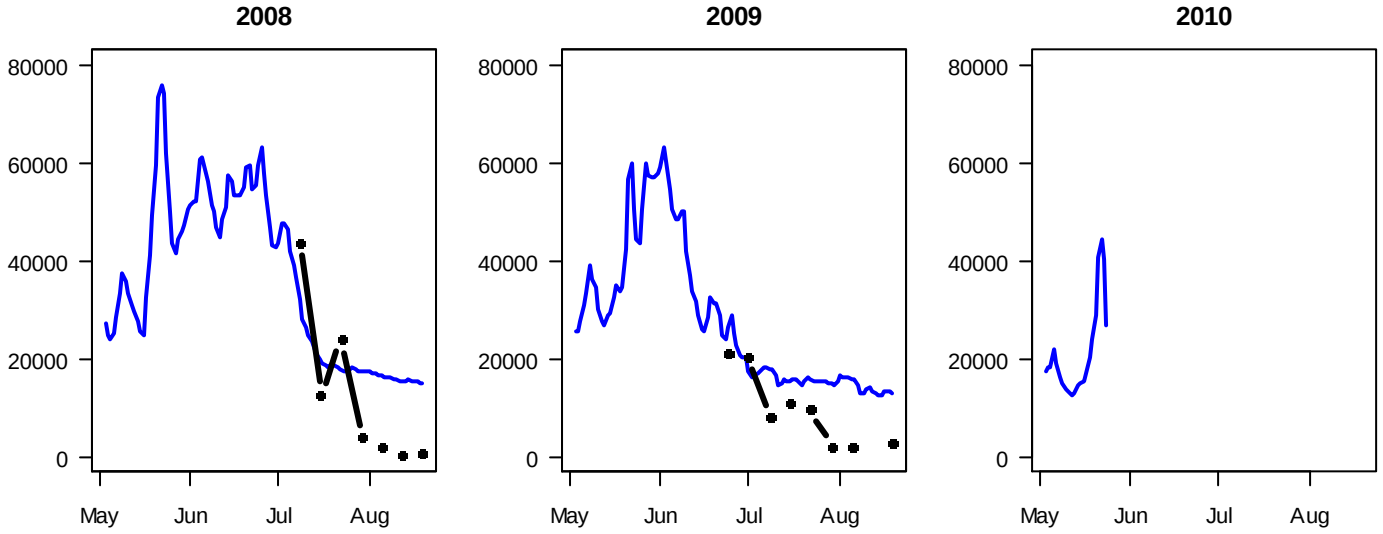


Clearwater 2005-2009

Flow

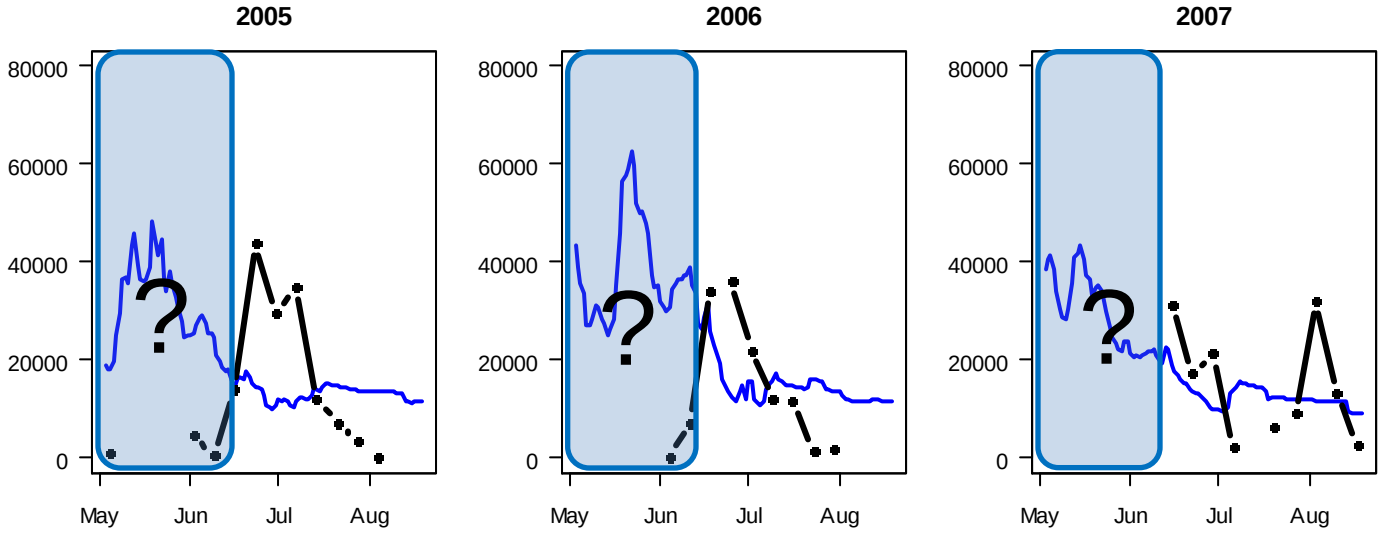


Flow

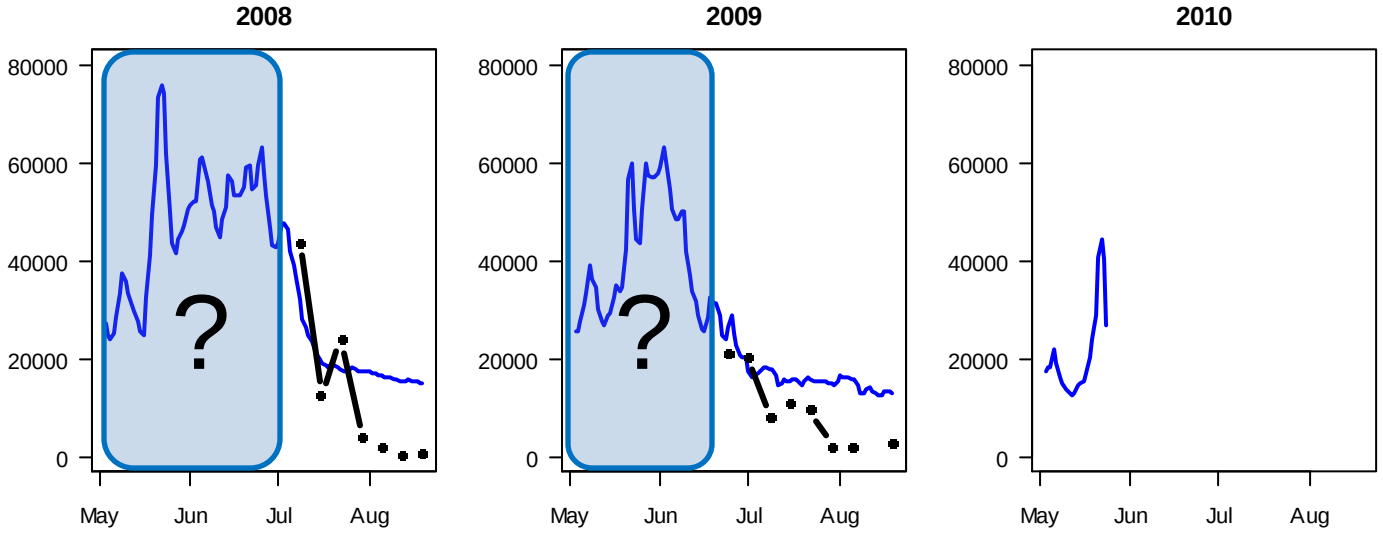


Clearwater 2005-2009

Flow

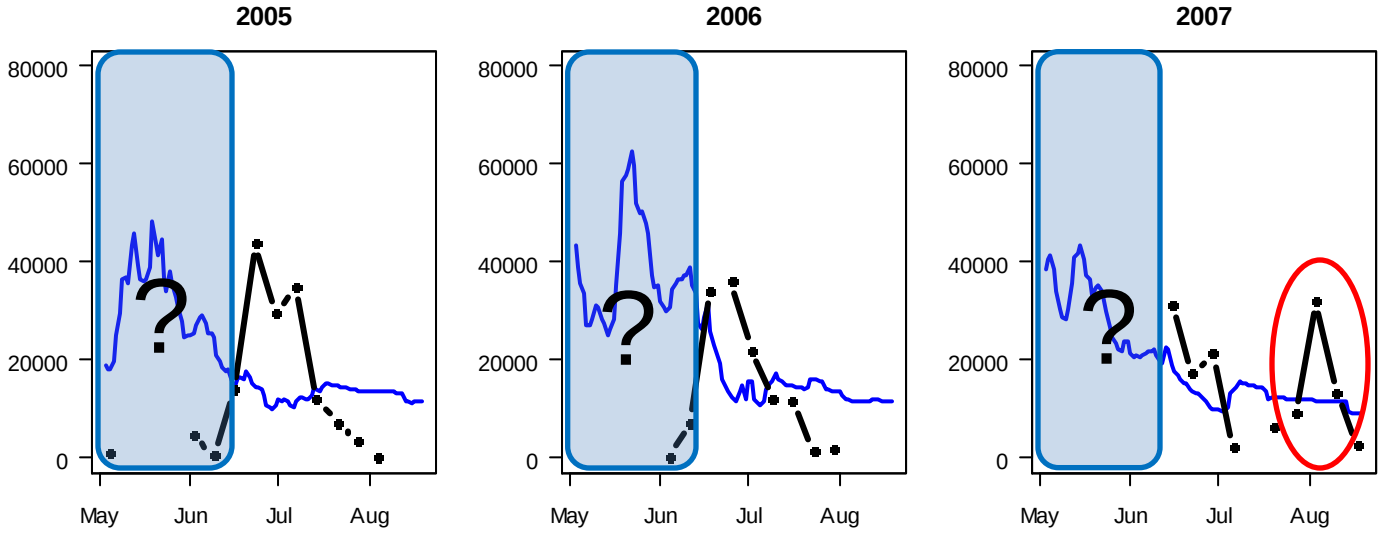


Flow

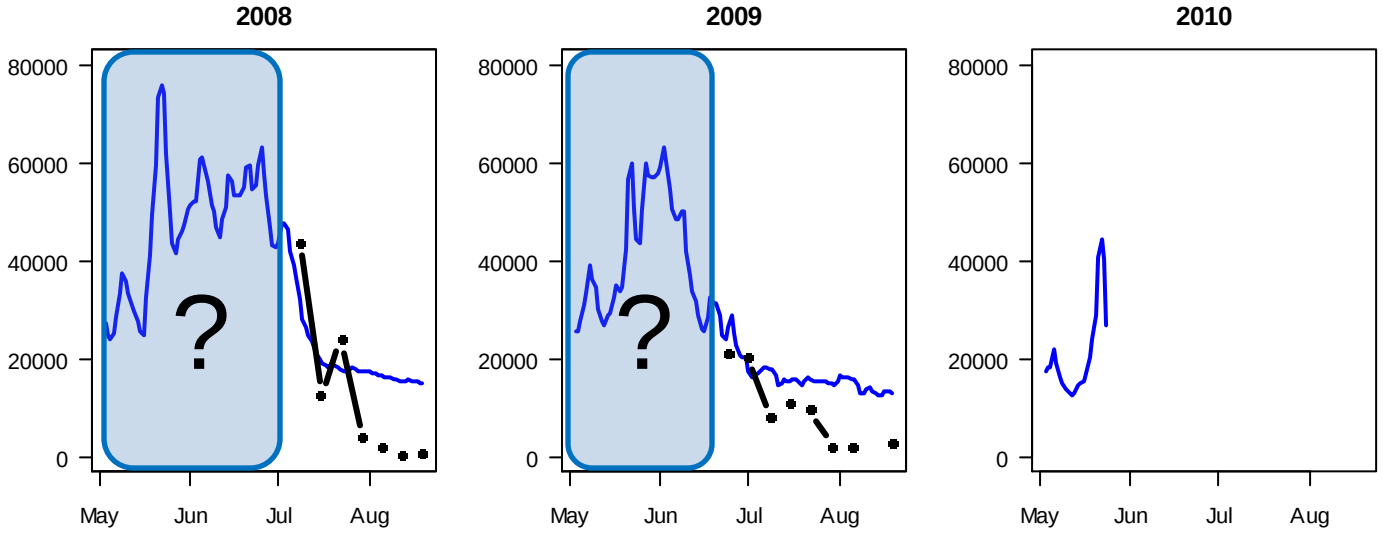


Clearwater 2005-2009

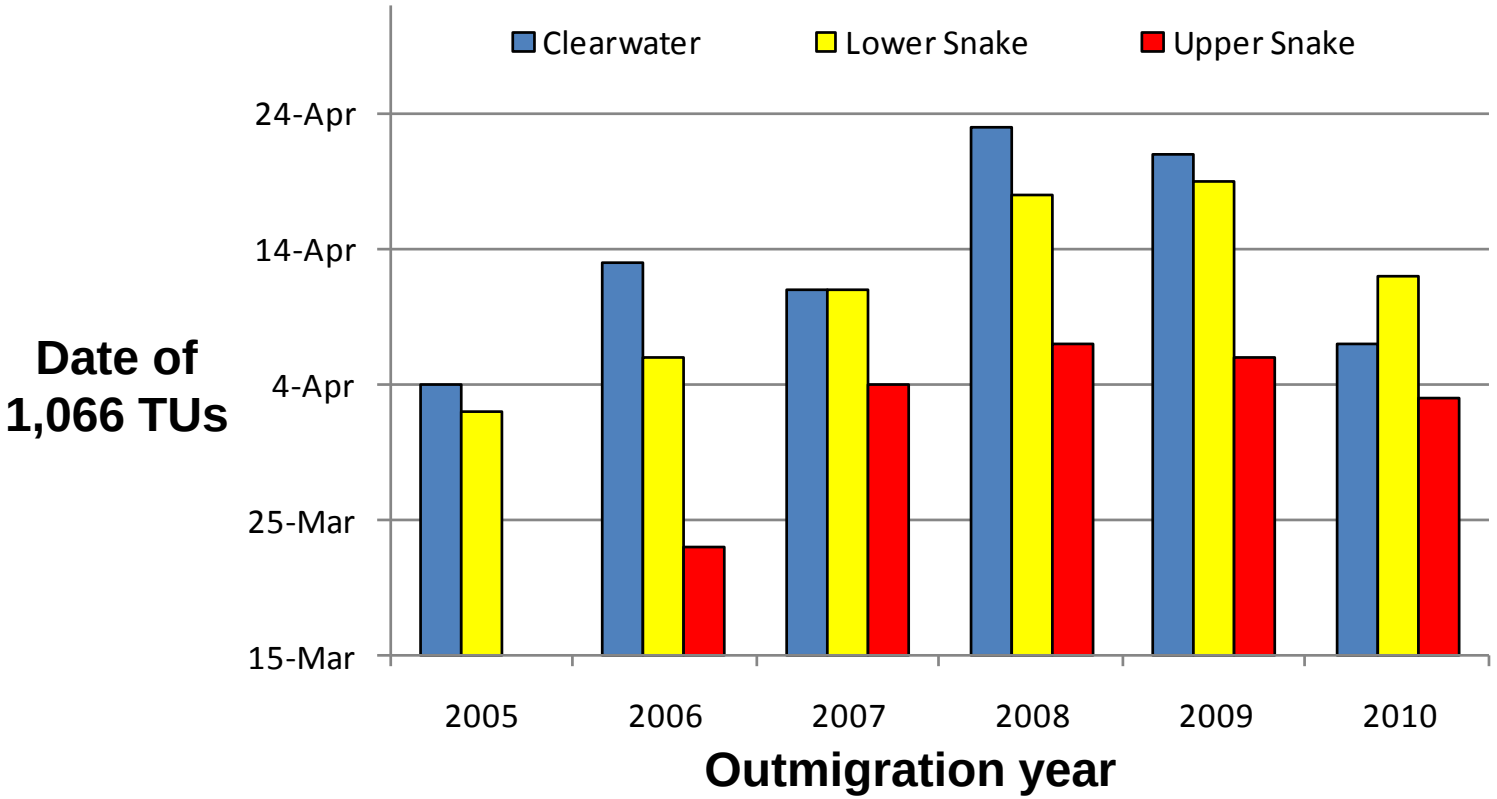
Flow



Flow



Incubation temperature units: Clearwater vs. Snake



Clearwater first emergence is 4 to 13 days later than Snake on average

Clearwater surrogates released 37 days after Snake surrogates on average

Conclusions

Catchability appears to vary with flow in both the Snake and Clearwater

Ignoring the influences of catchability on CPUE (and the resulting tag-release distribution) can lead to inaccuracies in characterizing the sampled population

The “instant peak” CPUE observations for the Clearwater are problematic. A substantial portion of the population may not be vulnerable to sampling due to high flows.

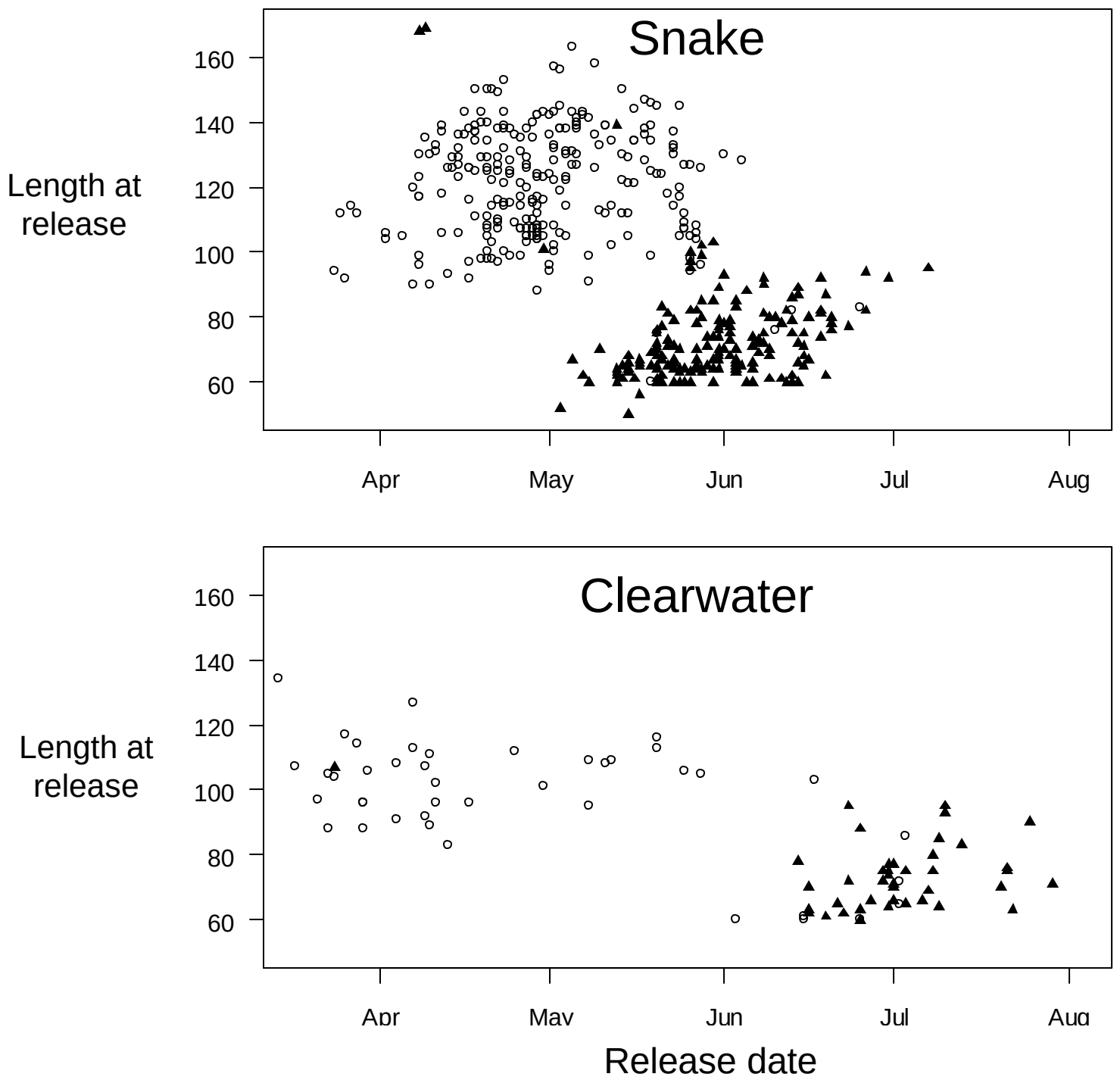
As a result, the Clearwater surrogate releases may not be reflecting the size and migration timing of the Clearwater population

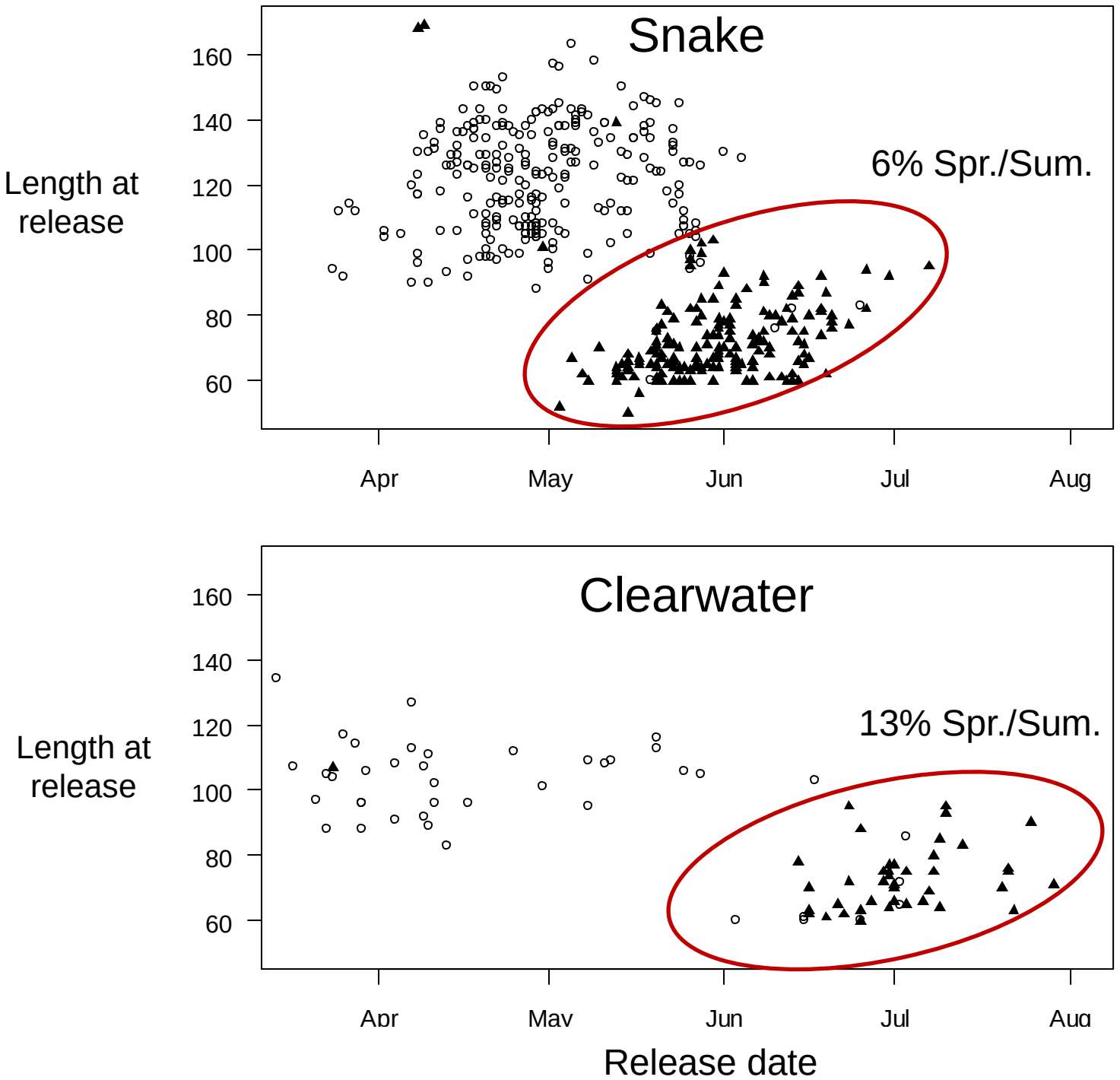
Run identification

Chinook collected in the wild may be spring, summer, or fall run types

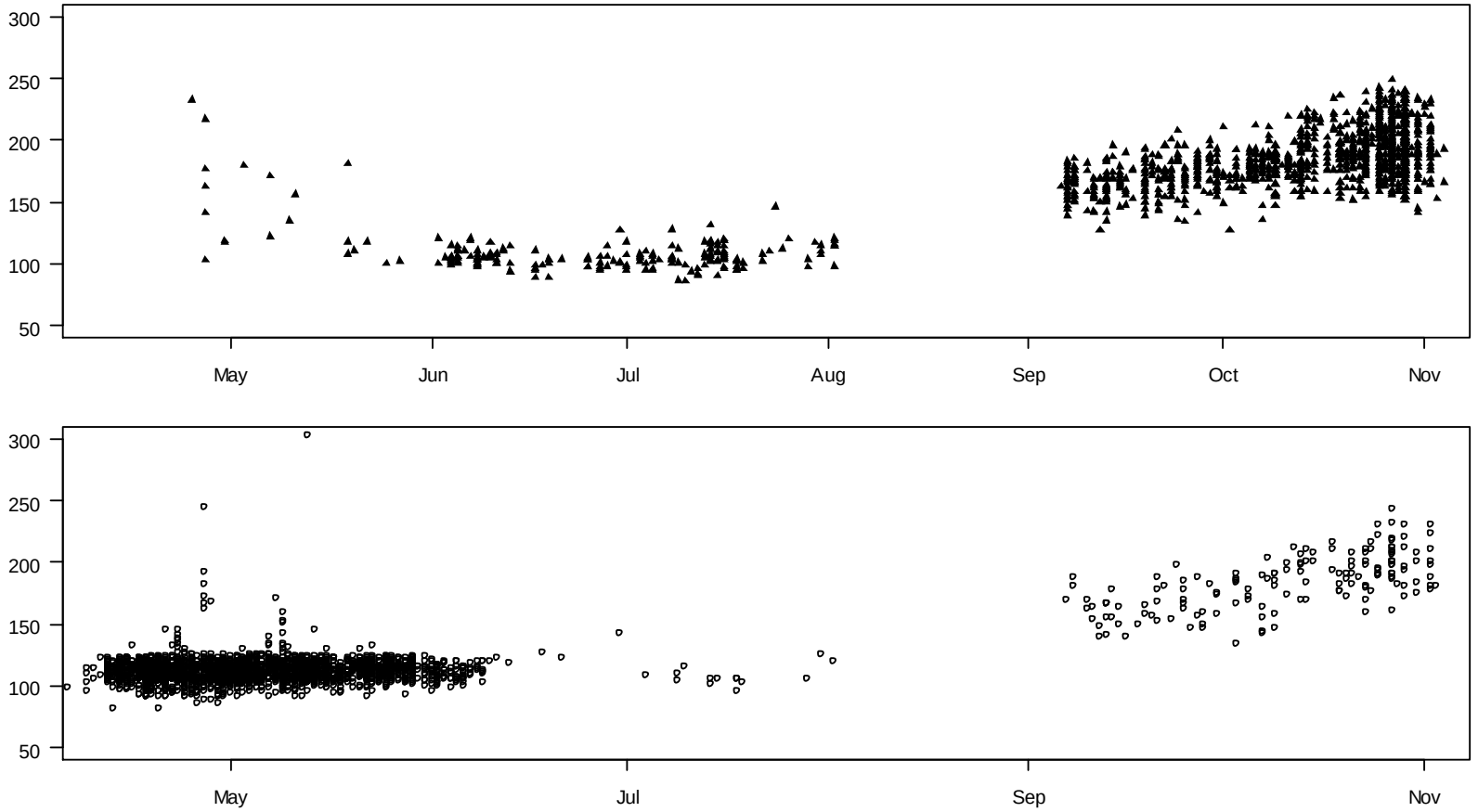
Can location, length or tagging date be used to reliably determine run type?

Examined adult return timing for Chinook tagged in the Snake and Clearwater rivers (seining and smolt traps), as well as tagging at LGR

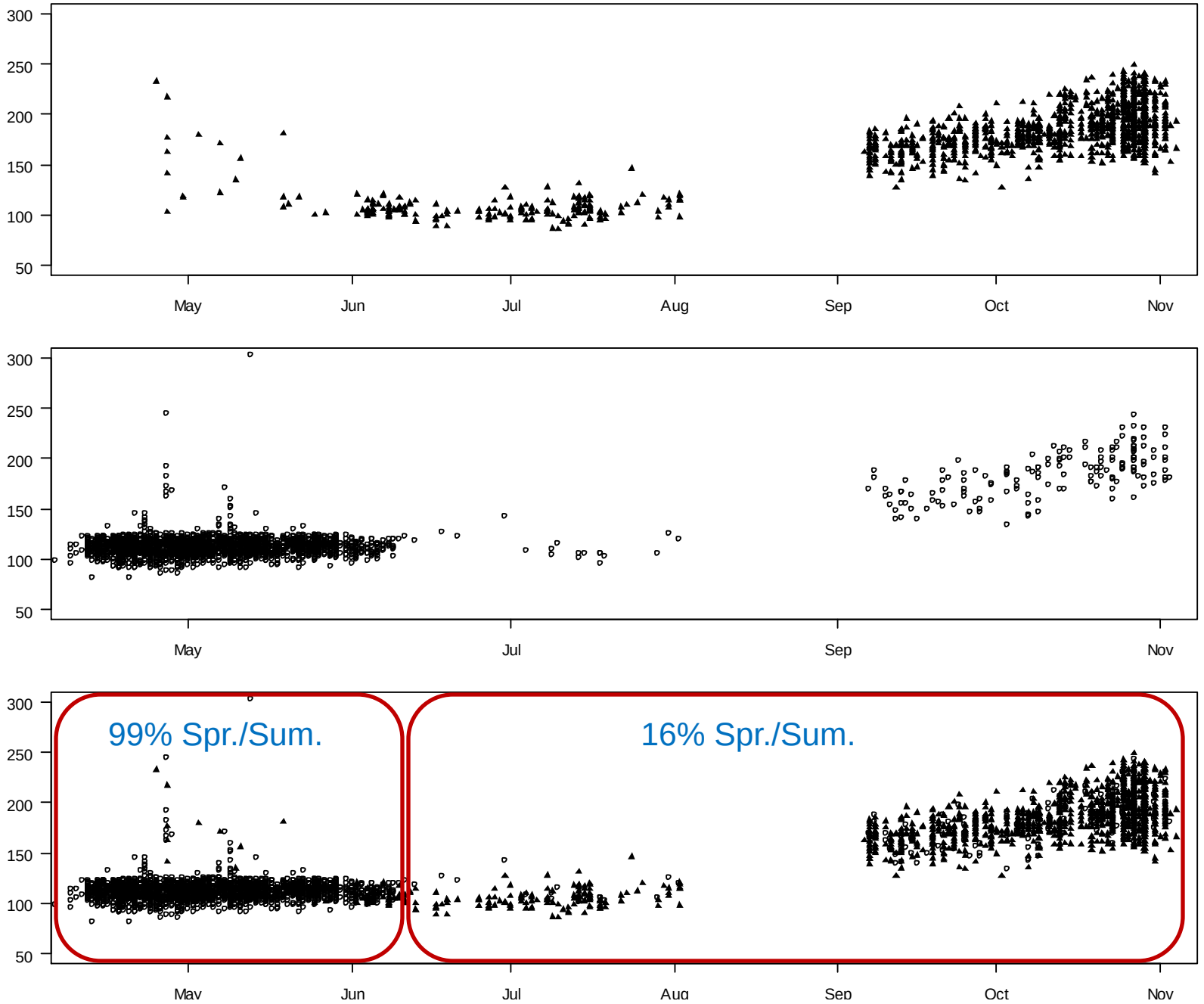

Snake
Clearwater
Length at release
Length at release
160
140
120
100
80
60
Apr
May
Jun
Jul
Aug
Release date


Snake
6% Spr./Sum.
Length at release
160
140
120
100
80
60
Apr
May
Jun
Jul
Aug
Clearwater
13% Spr./Sum.
Length at release
160
140
120
100
80
60
Apr
May
Jun
Jul
Aug
Release date

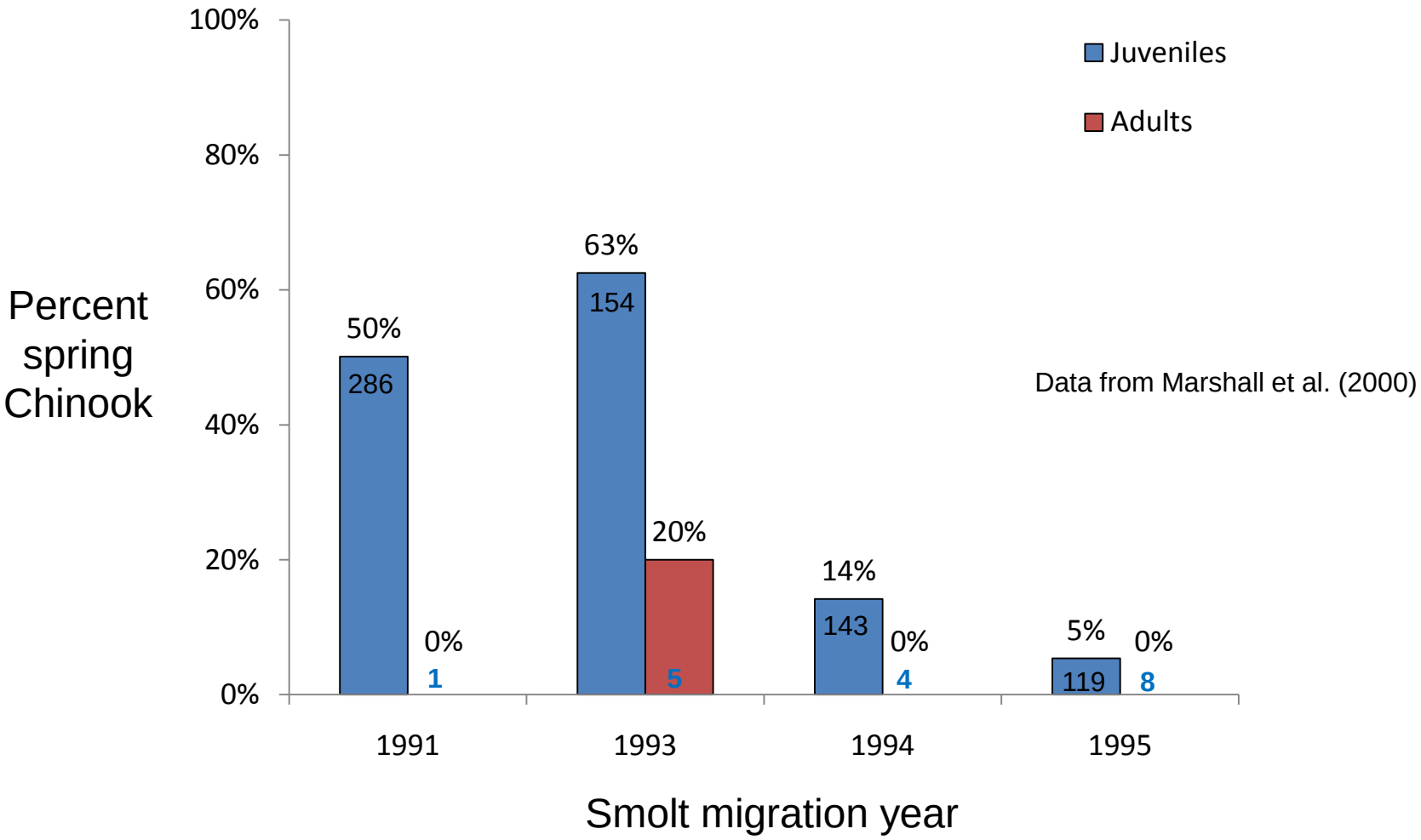
Lower Granite tagging



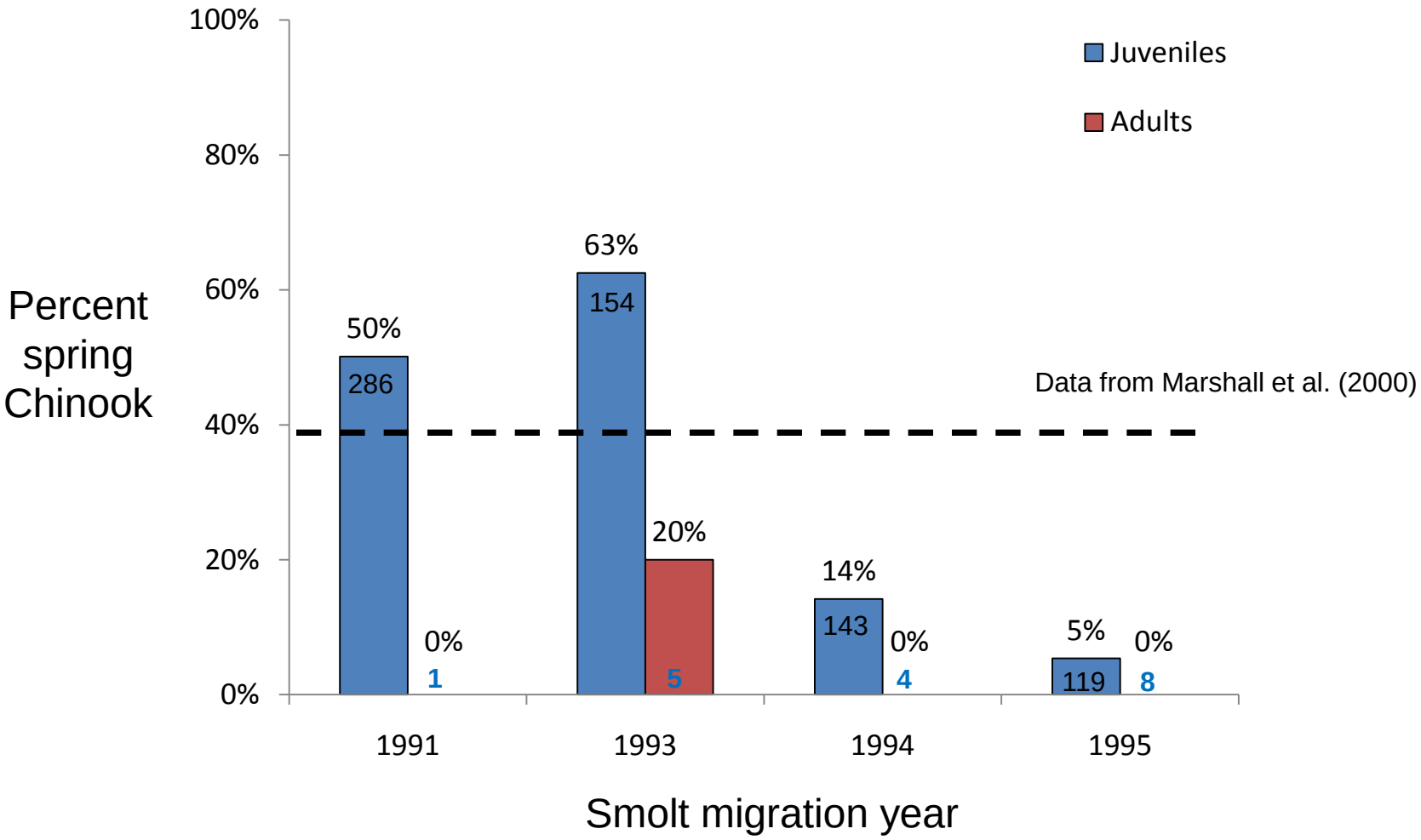
Lower Granite tagging



Run-type proportions based on adult detections may be underestimates of the smolt run-type proportions :



Run-type proportions based on adult detections may be underestimates of the smolt run-type proportions :



Conclusions

Length, tagging location and release appear inadequate to definitively determine run-type

Substantial numbers of spring/summer Chinook tagged at Lower Granite during late summer/fall

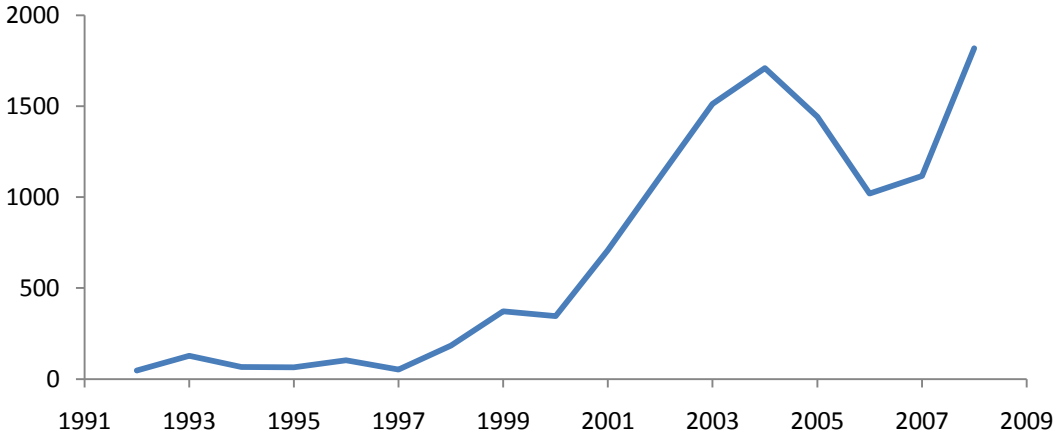
Do different run-types exhibit different migration behaviors?

Without genetic samples, there is a need for caution in declaring Chinook as belonging to a particular run-type among samples collected in the wild

Rear-type identification (hatchery or naturally-produced)

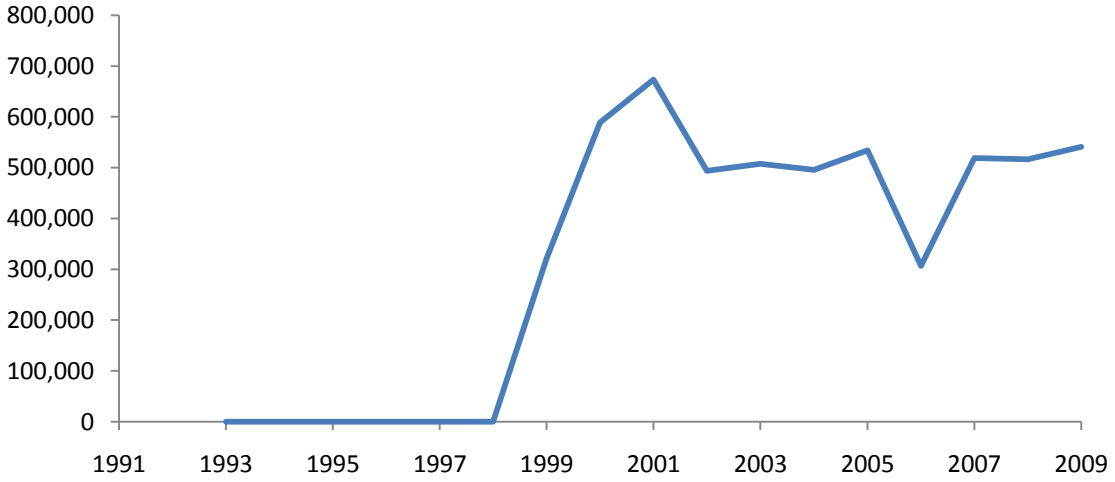
Source of uncertainty that could affect interpretation of observations of fish assumed to be of natural origin

Snake redds

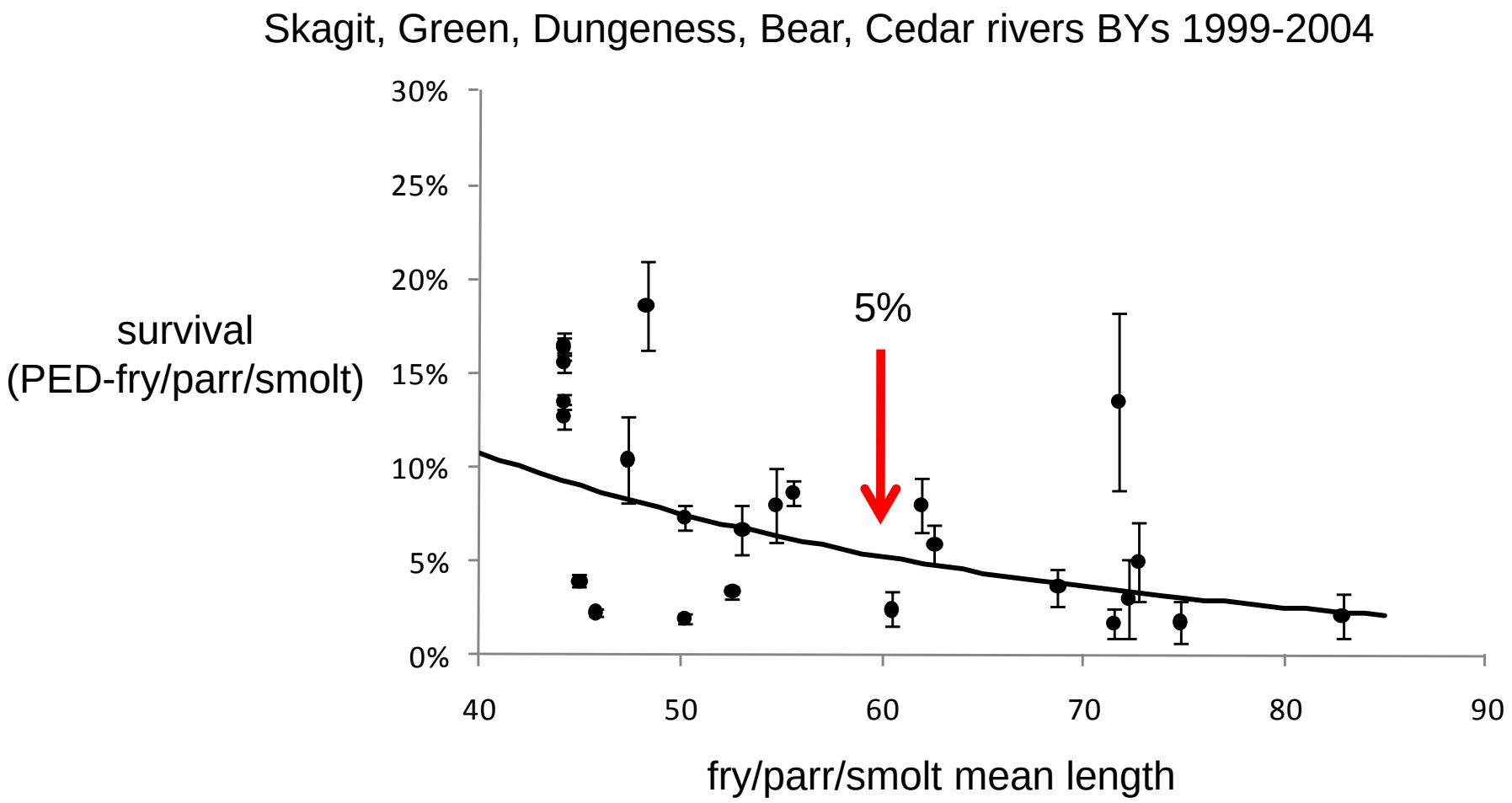


80-90% classification accuracy

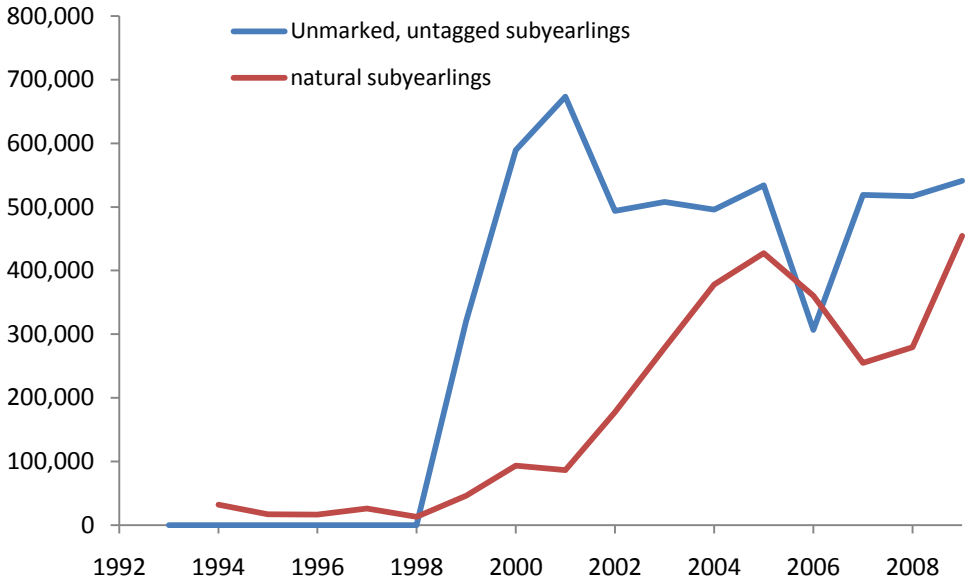
Unmarked, untagged subyearlings



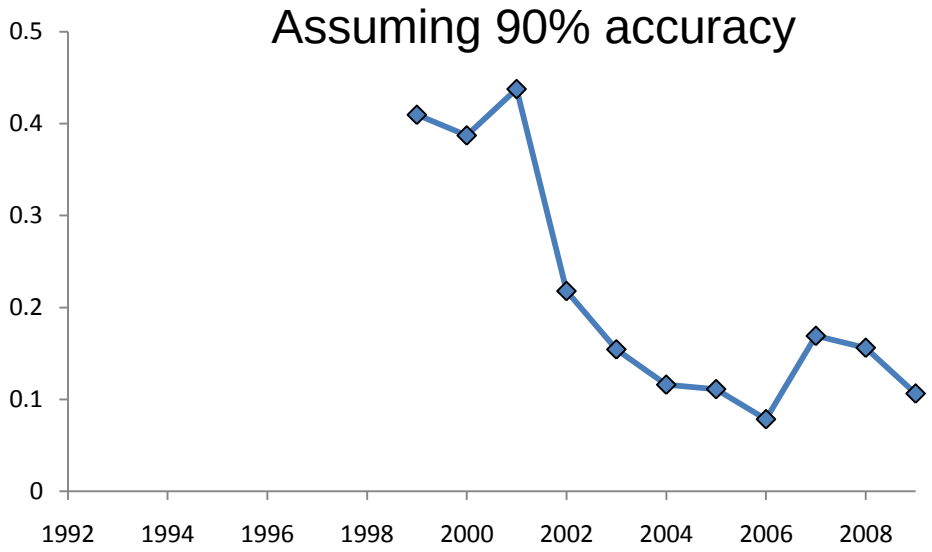
Multi-stock synthesis of ocean-type Chinook survival rates



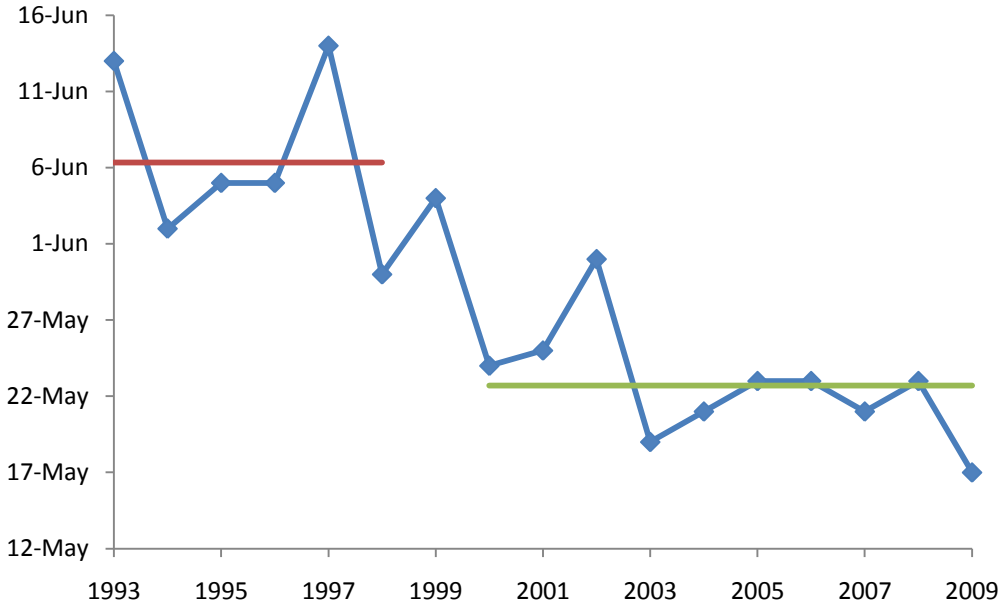
Number of subyearlings



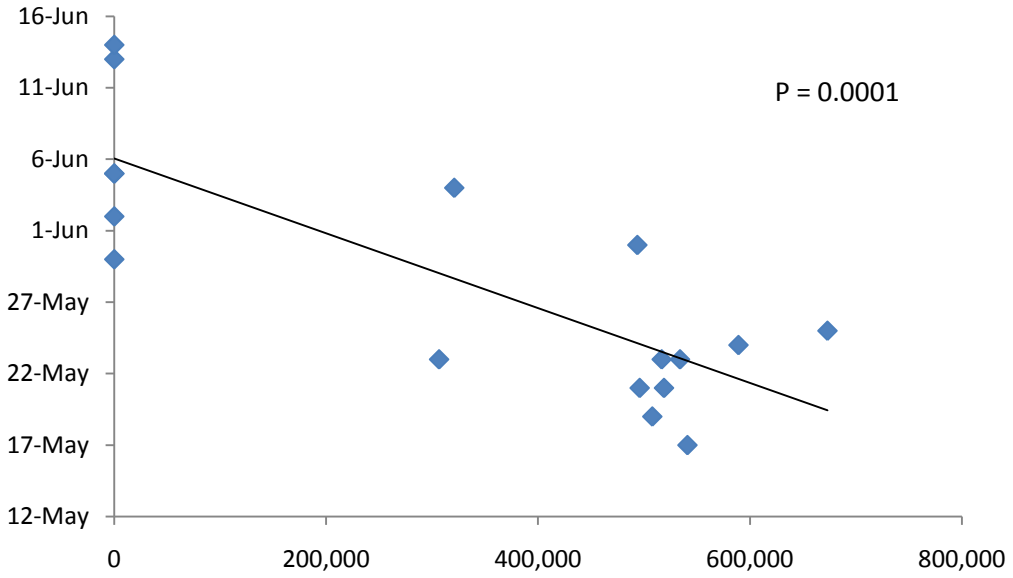
Hatchery-origin fraction of sample



Snake 15W mean tagging date



Snake 15W mean tagging date



Unmarked, untagged hatchery subyearlings

Conclusions

Large releases of untagged, unmarked hatchery-origin fish can contaminate “wild” samples, even under high classification accuracy

Given recent increases in redd counts, the potential for hatchery misidentification may be reduced, but does not appear to be eliminated

"The Chinook, like all *Oncorhynchus* species, is anadromous and semelparous. Within this general life history strategy, however, chinook display a broad array of tactics, including length of freshwater, estuarine, and oceanic residence, variation in ocean distribution and ocean migratory patterns, and variation in age and season of spawning migration." Healey (1991)

"A strategy is a genetically determined life history or behavior program which has evolved because it maximizes fitness (lifetime reproductive success) under frequency-dependent intraspecific competition."

"Strategies are composed of tactics: the ontogenetic stages of development or actions specifically used for achieving given life history or behavior programs. Strategies therefore evolve through alterations in their tactics."

Gross, M.R. (1987)

"reservoir-type life history" does not always equal yearling scale pattern

Moving forward…

Recognize (and exploit) the conditioning inherent in the PIT-tag data

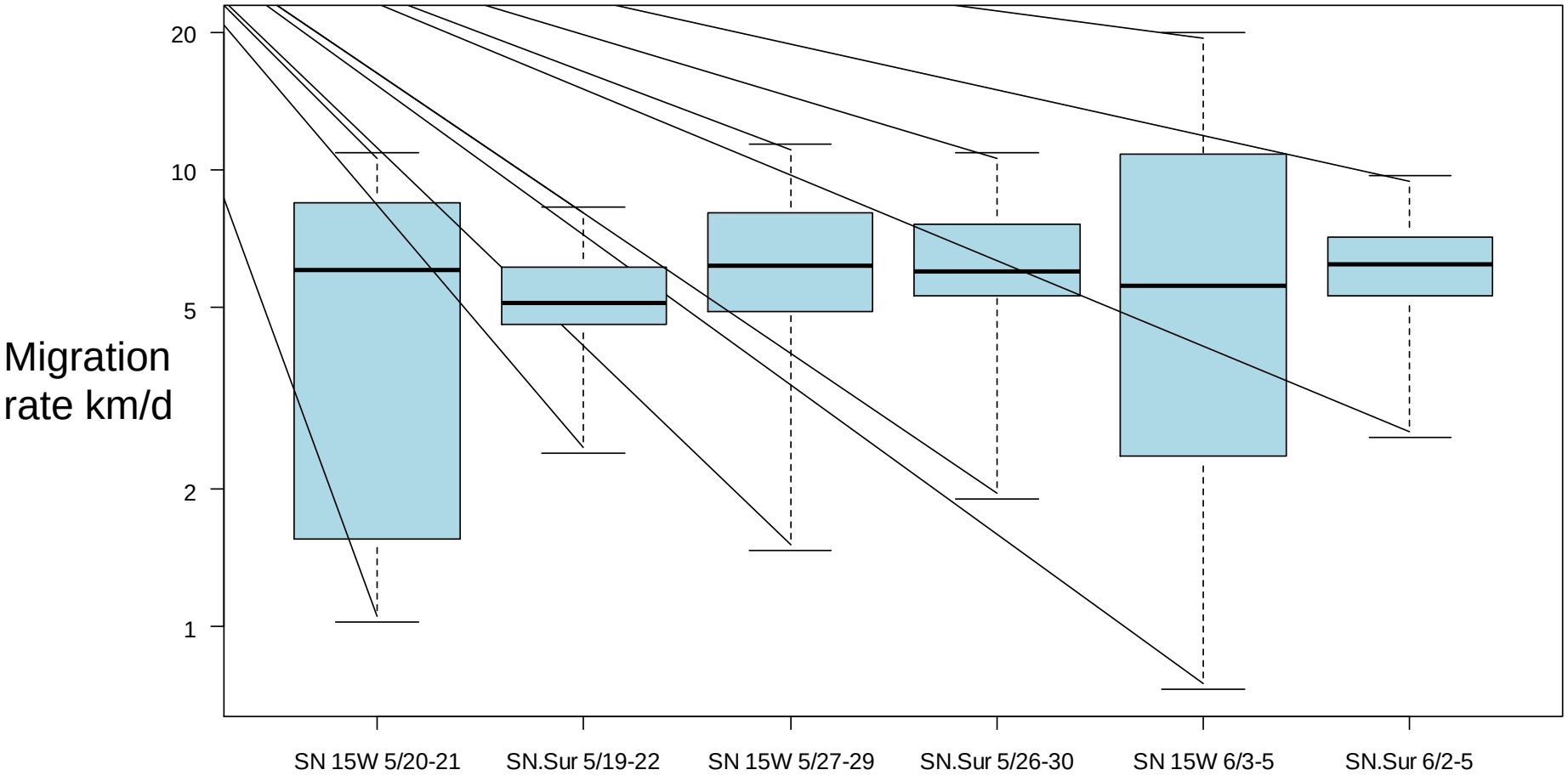
Explicitly incorporate known factors into analyses: release location, length, release date, rear-type across multiple releases

Quantify how known factors affect observed demographic processes in an effort to improve understanding of sources of variation- the why's

More attention should be directed at examining the sampling (fishing) processes that work to directly (13W, 15W) or indirectly (surrogate) create release distributions

Clearly state uncertainties in run-type, rear-type, catchability constraints when apparent

2008-09 migration rate from release location to IHR



2008-09 migration rate from release location to IHR