Characterizing outmigrant juvenile salmon behavior through the Lake Washington Ship Canal using ultrasonic telemetry

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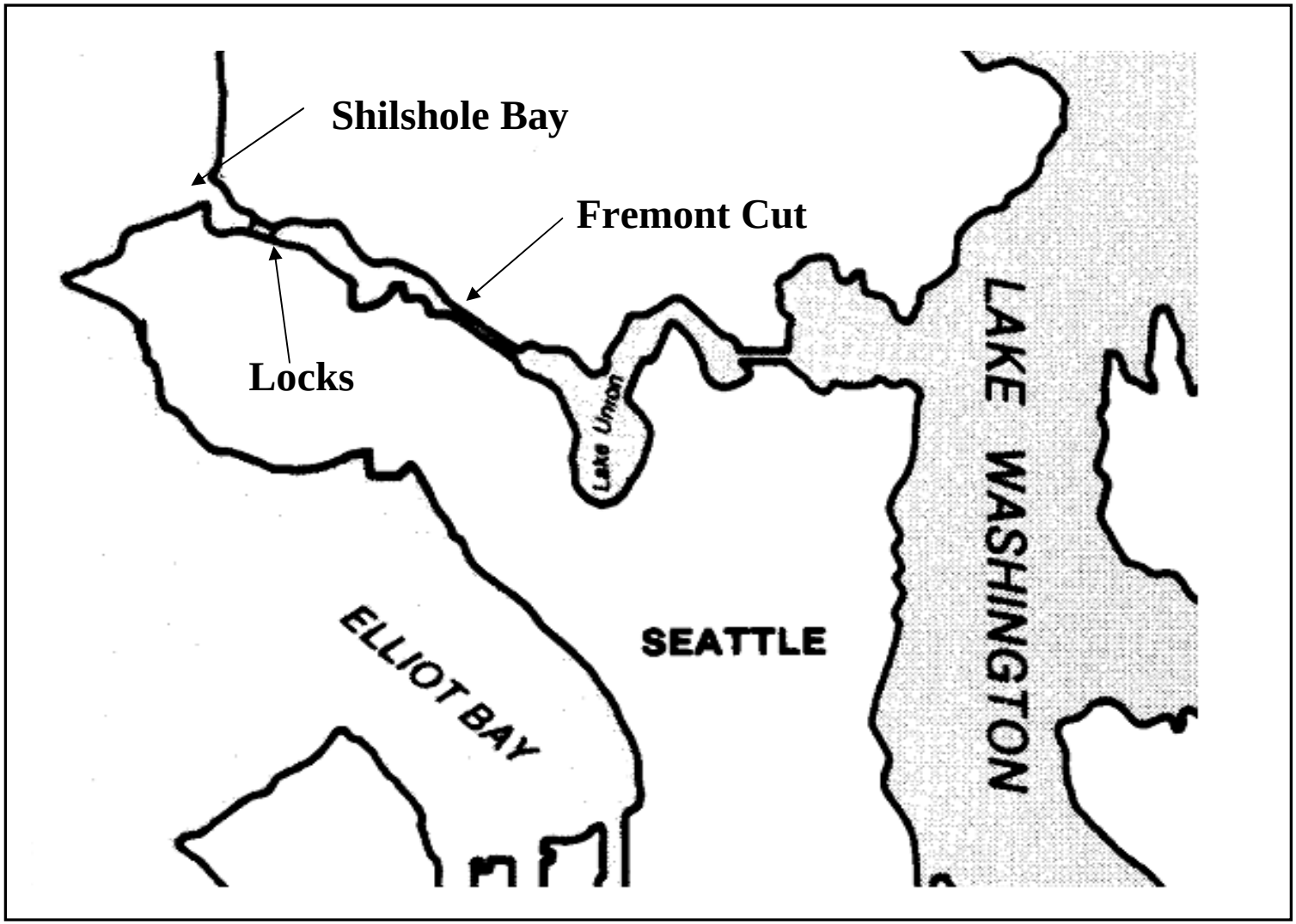
Objectives

- **Characterize juvenile chinook behavior and habitat use in urbanized Lake Washington Ship Canal, Lake Union System and Shilshole Bay nearshore marine areas**
- **Determine residence time in selected areas of the Ship Canal: Montlake to Fremont; Fremont Cut to the Locks; Locks passage time to inner Shilshole Bay**

Objectives (cont.)

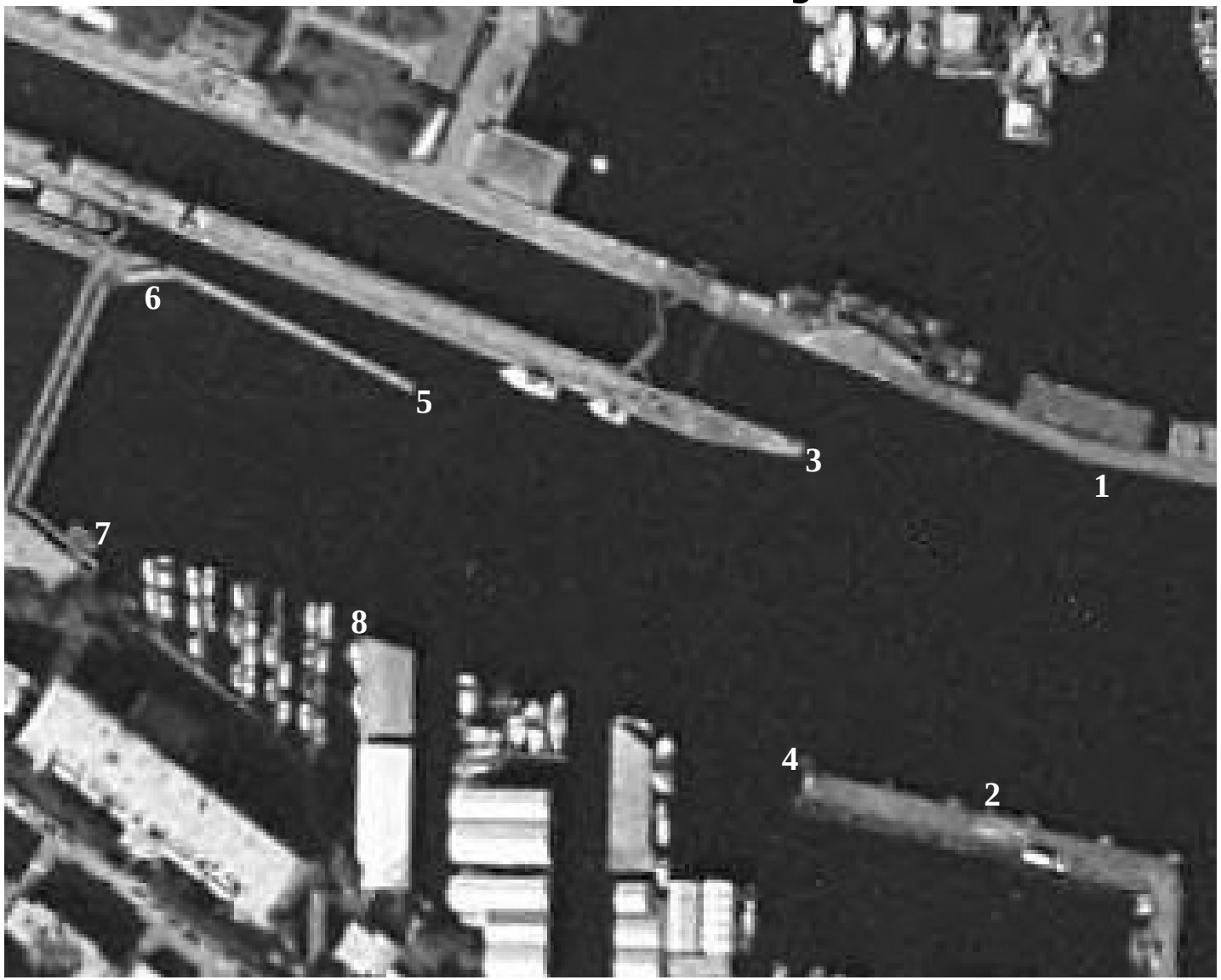
- **Determine pathway selection as smolts migrate through the Locks**
- **Estimate survival from release points to the Locks for groups released at either Montlake or Fremont**

Study Sites

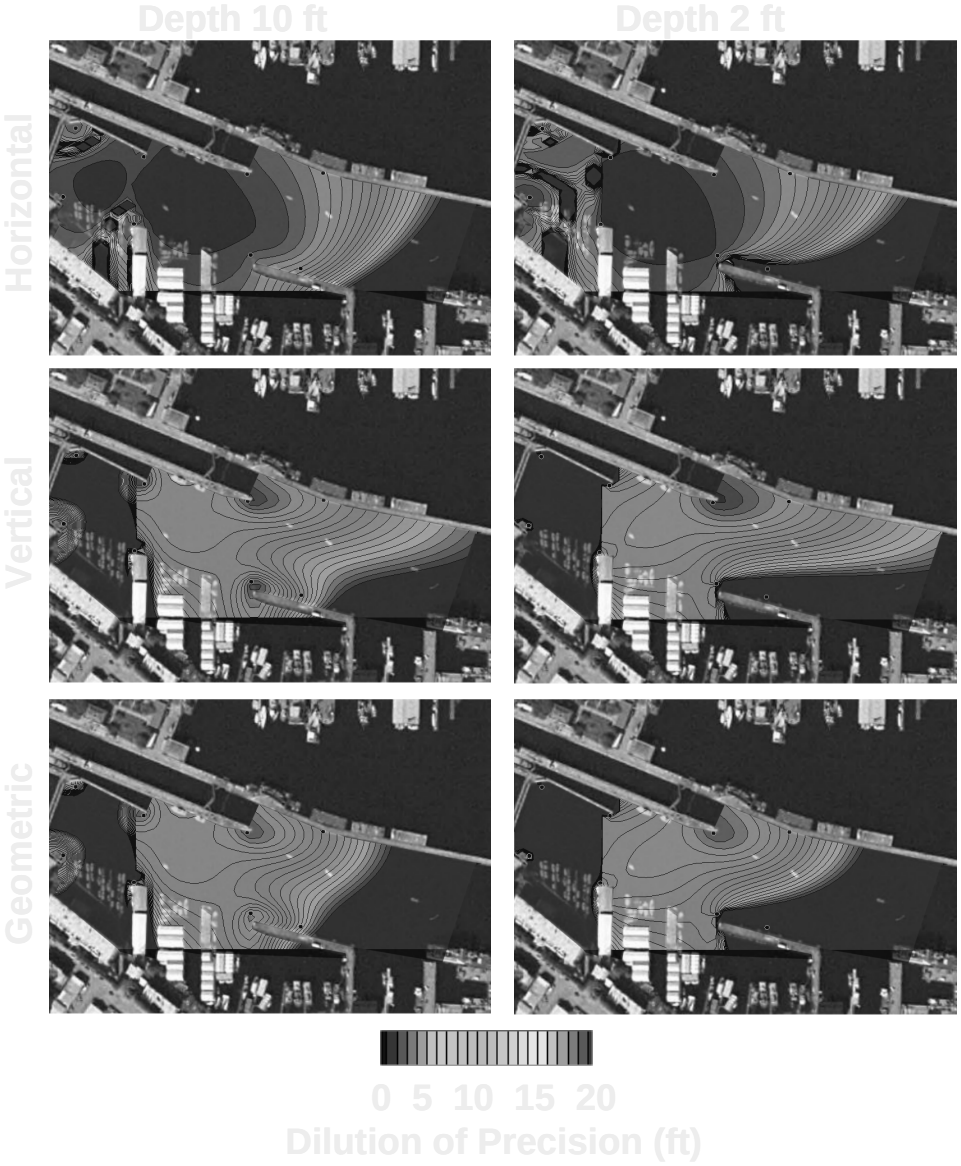

Shilshole Bay
Fremont Cut
Locks
Lake Union
LAKE WASHINGTON
SEATTLE
ELLIOT BAY

Fremont Cut Array

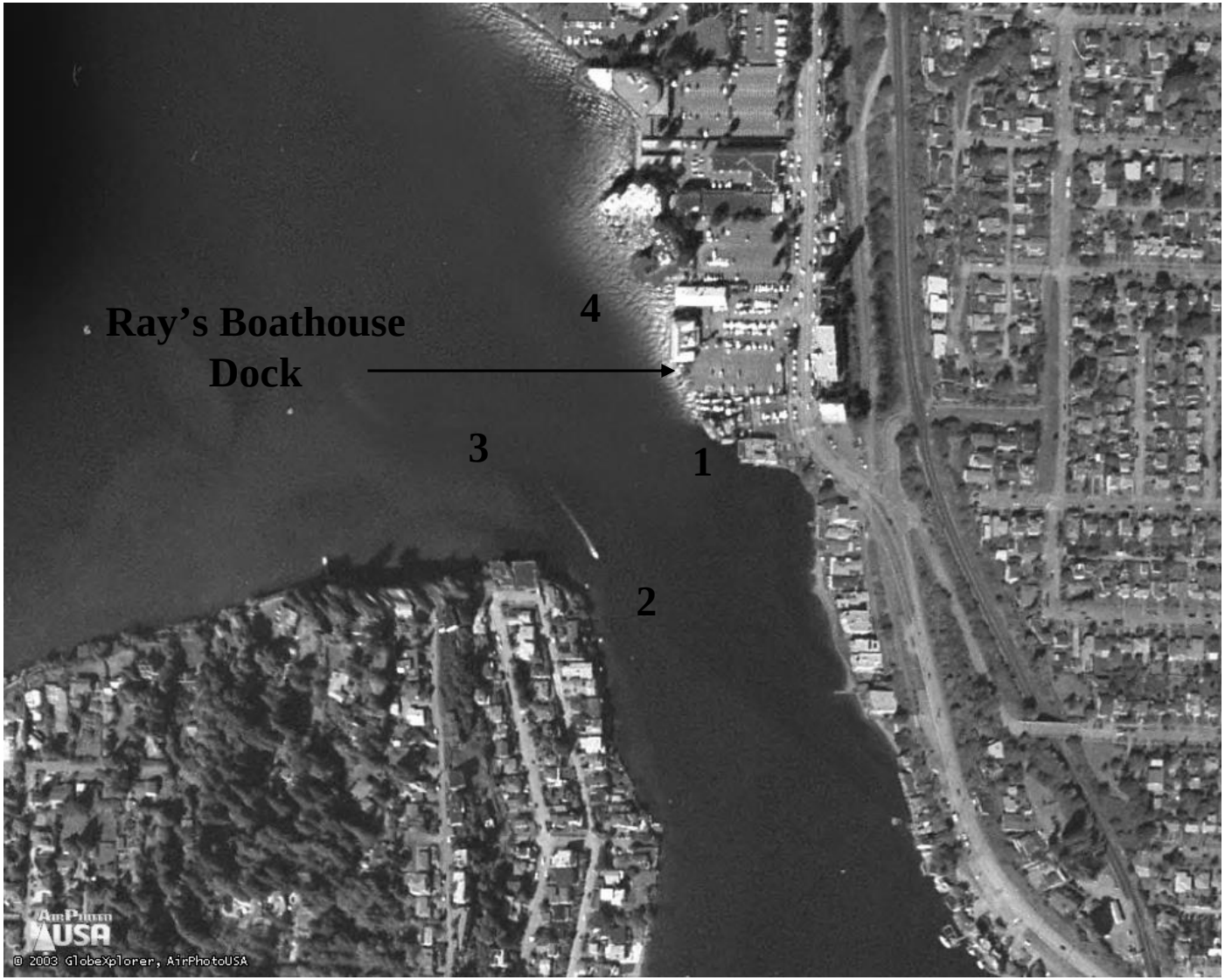
Locks Array



Error Estimation



Shilshole Array



Hydrophone Deployment

Hydrophone Deployment

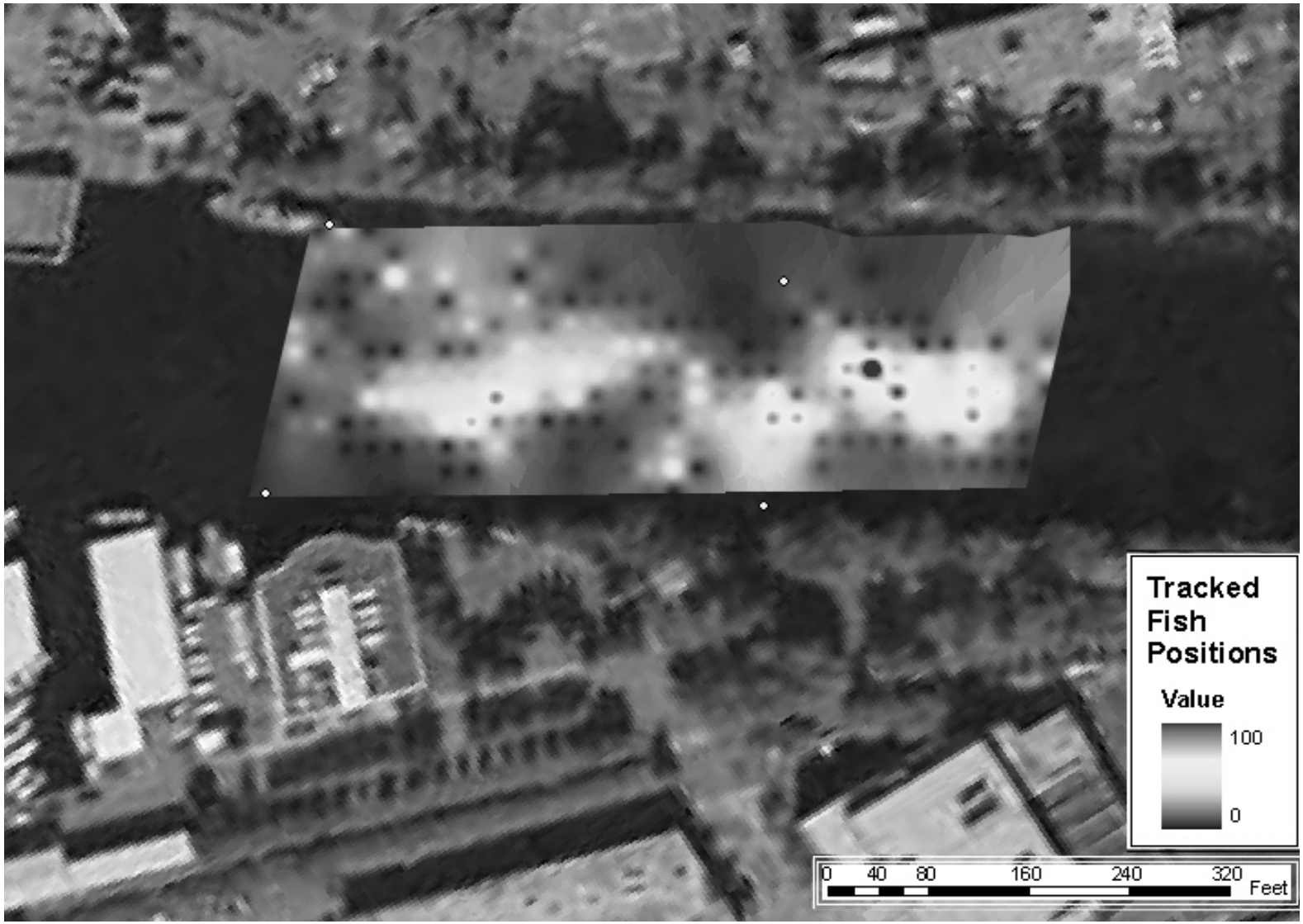
Tagging and Release

Release Group	# Tagged Chinook	# Tagged Coho	# Released Chinook	# Released Coho	Release Date	Release Loc.
1	8	9	1	2	6-Jun	Fremont Br.
2	14	8	2	7	13-Jun	Fremont Br.
3	8	0	6	0	23-Jun	Fremont Cut
Total	30	17	9	9		

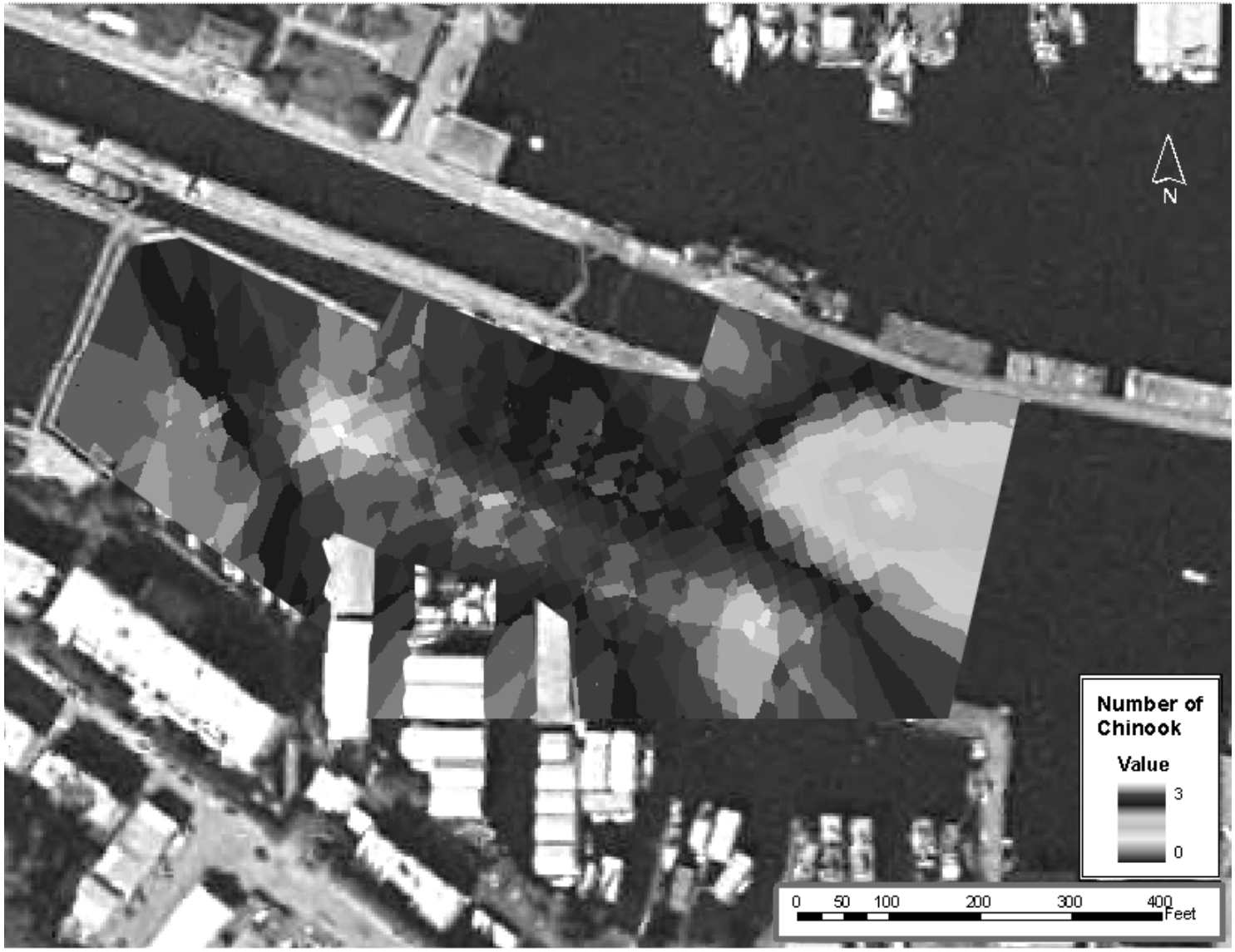
Results – Residence Times

			Residence Time or Time within Array (hr)		
Site	Species	N	Mean	Max	StDev
Fremont	Chinook	9	5.1	14	3.9
	Coho	5	2.0	4	1.4
Locks	Chinook	7	21.9	92	31.2
	Coho	4	24.0	47	16.4
Shilshole	Chinook	5	5.6	14	5.2
	Coho	3	1.7	3	1.2

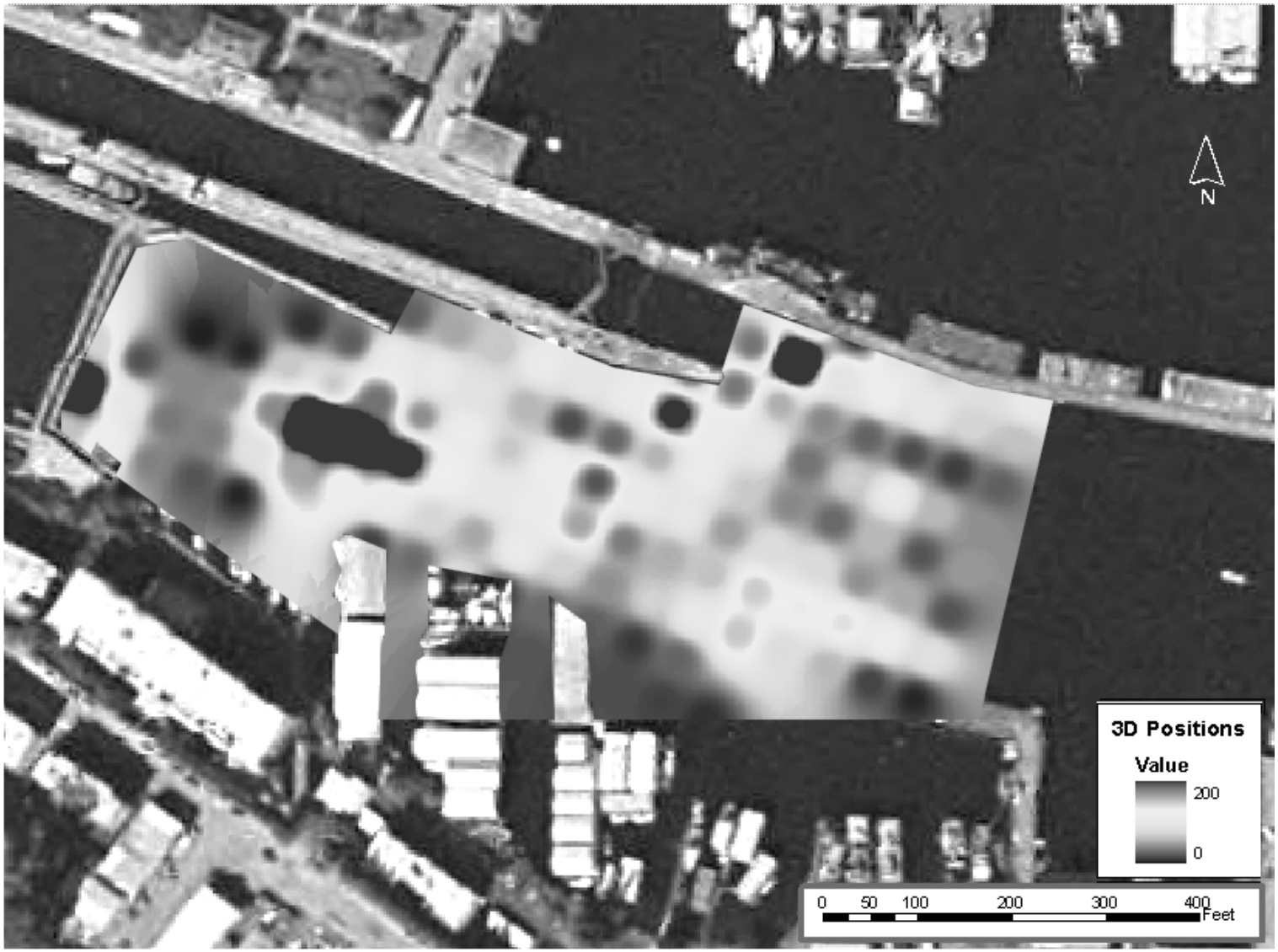
Lateral Distribution - Fremont



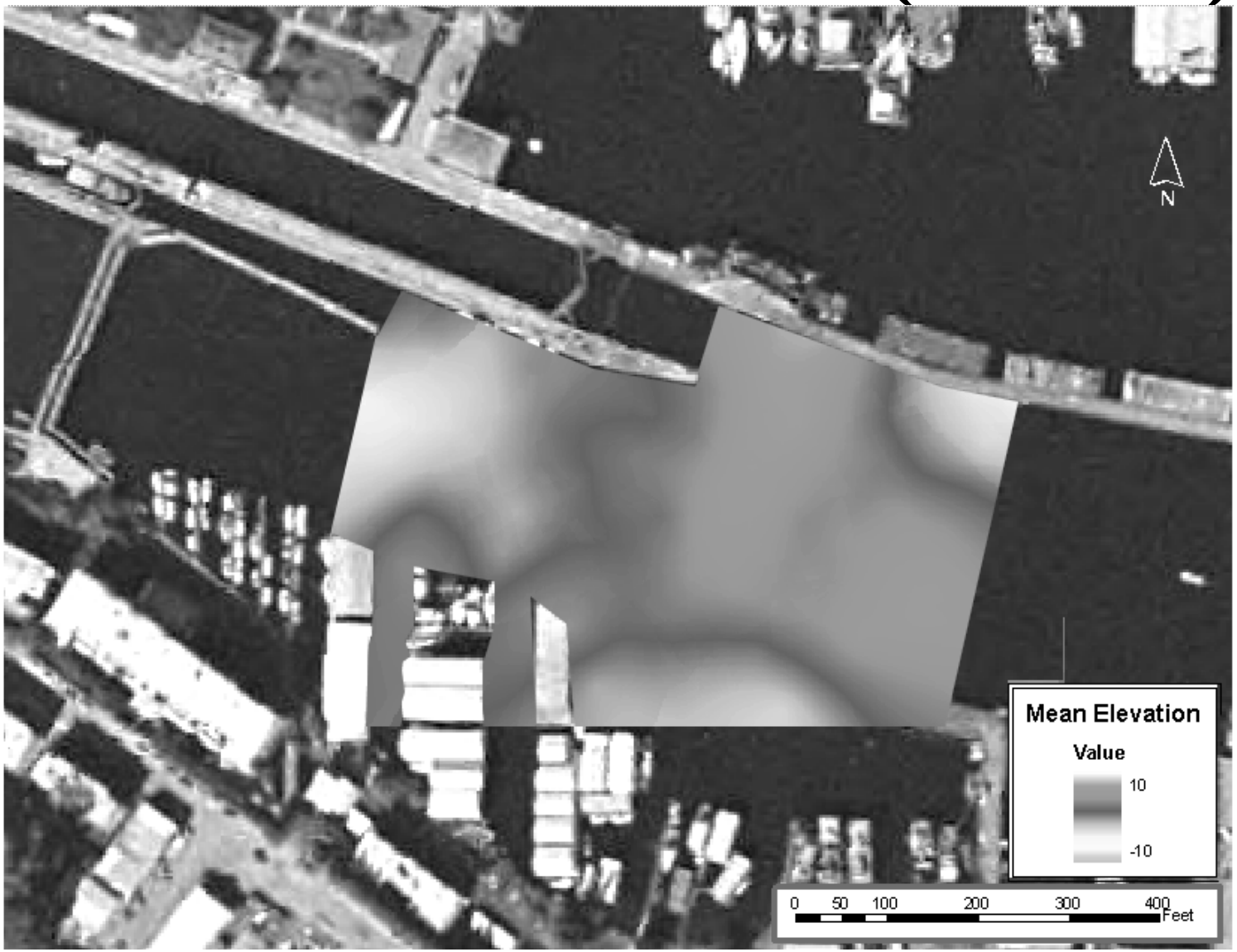
Locks – Chinook Positions



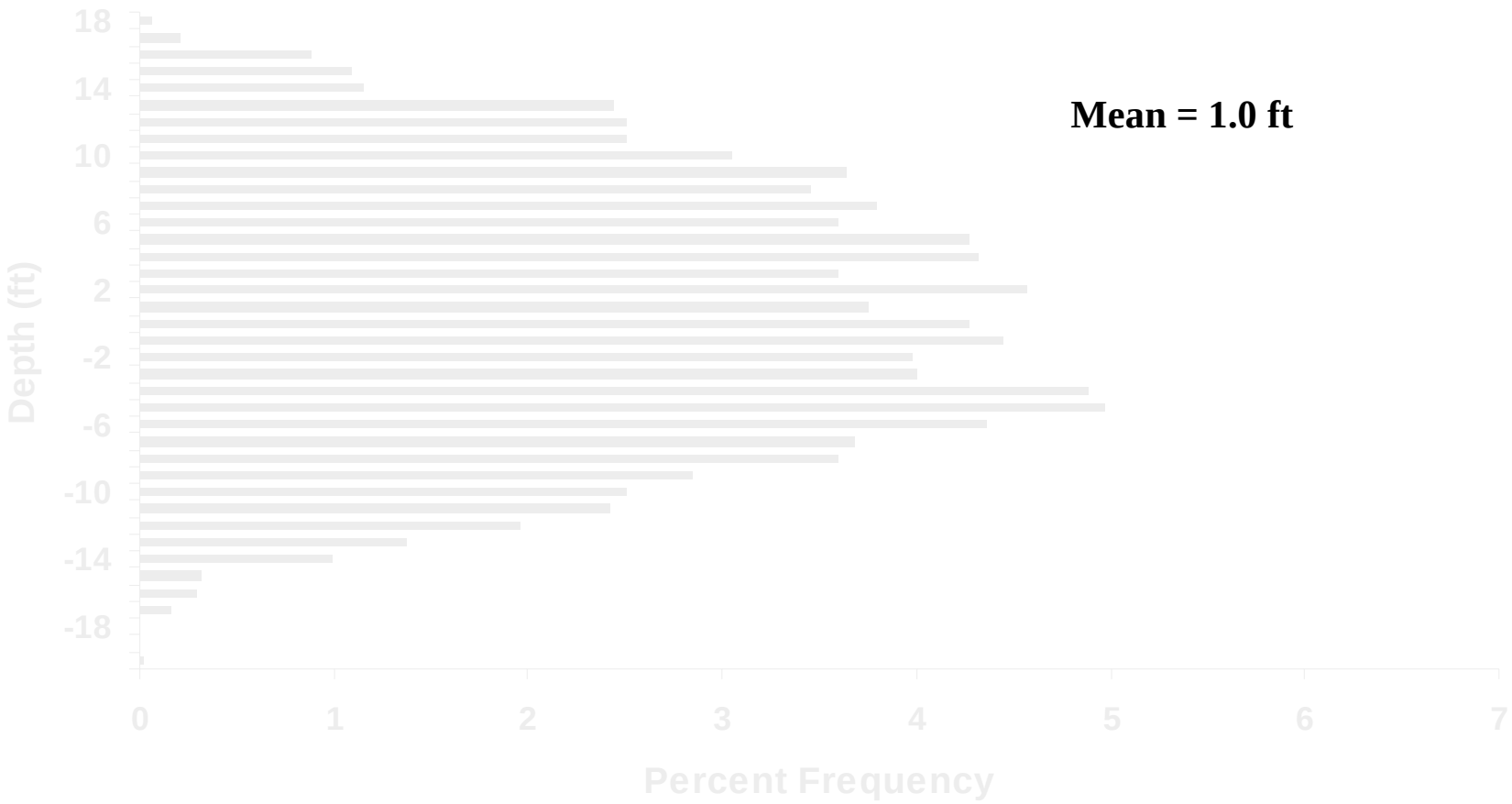
Locks – 3D Chinook Positions



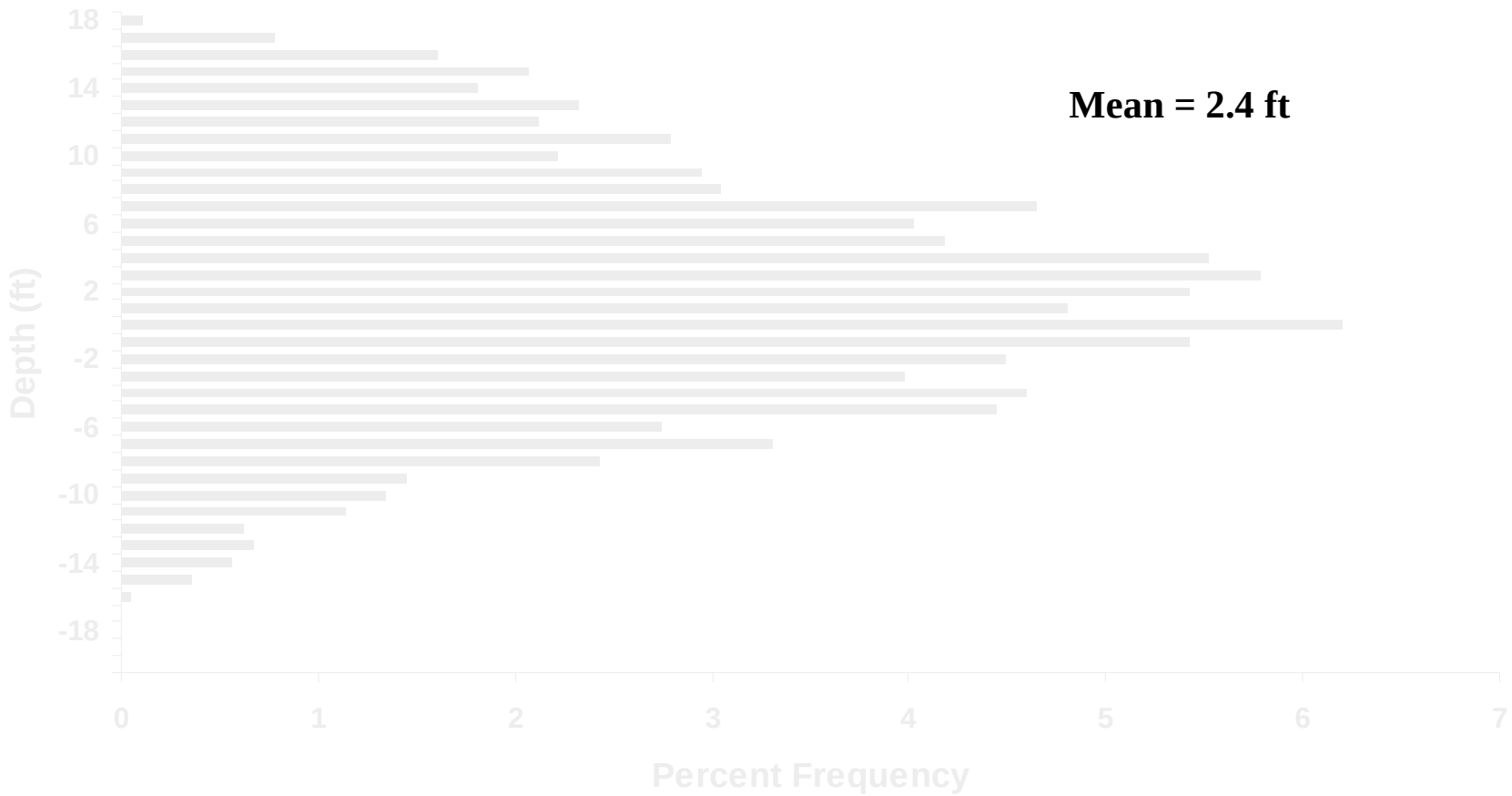
Locks – Mean Elevations (Chinook)



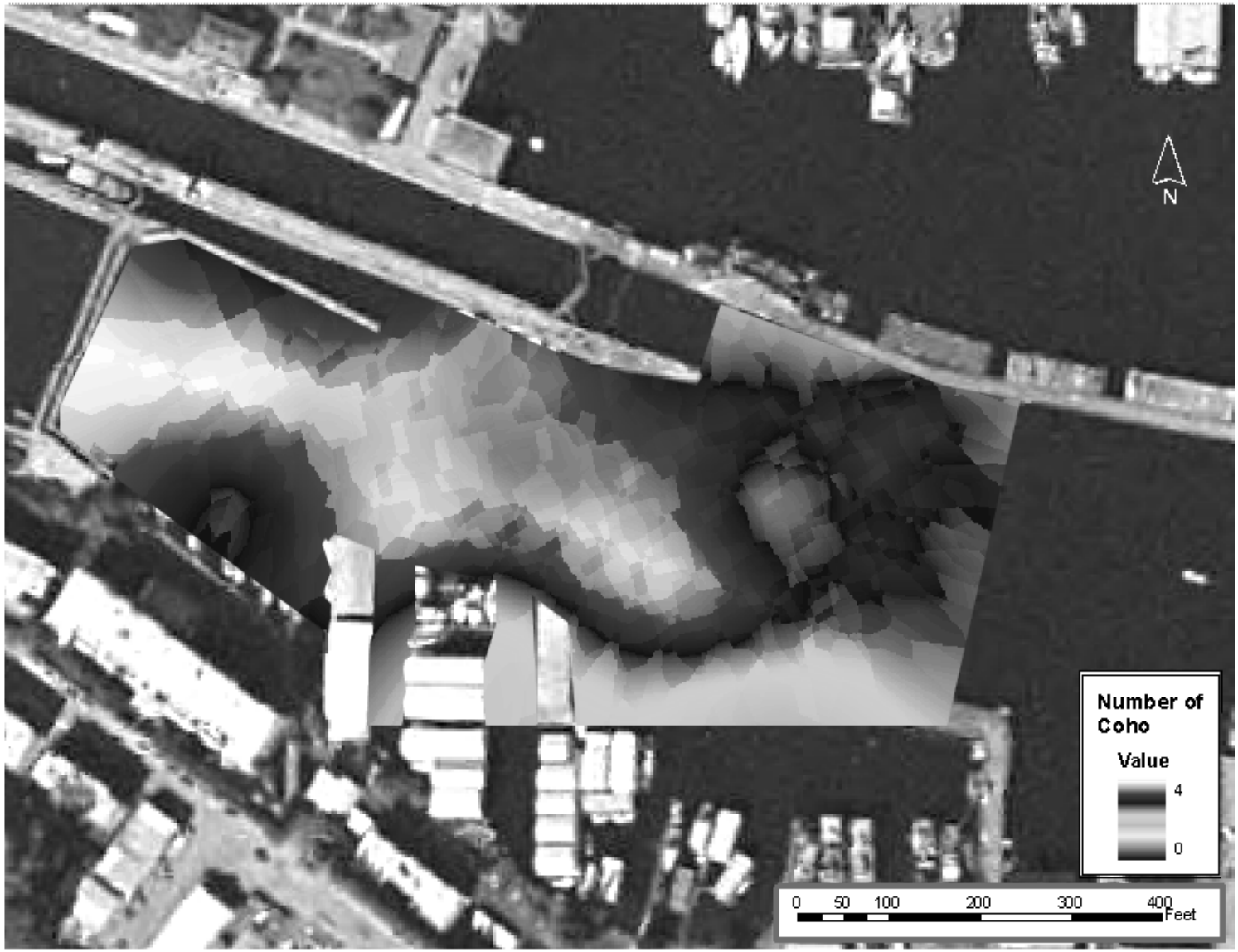
Locks – Vertical Dist. Chinook (Day)



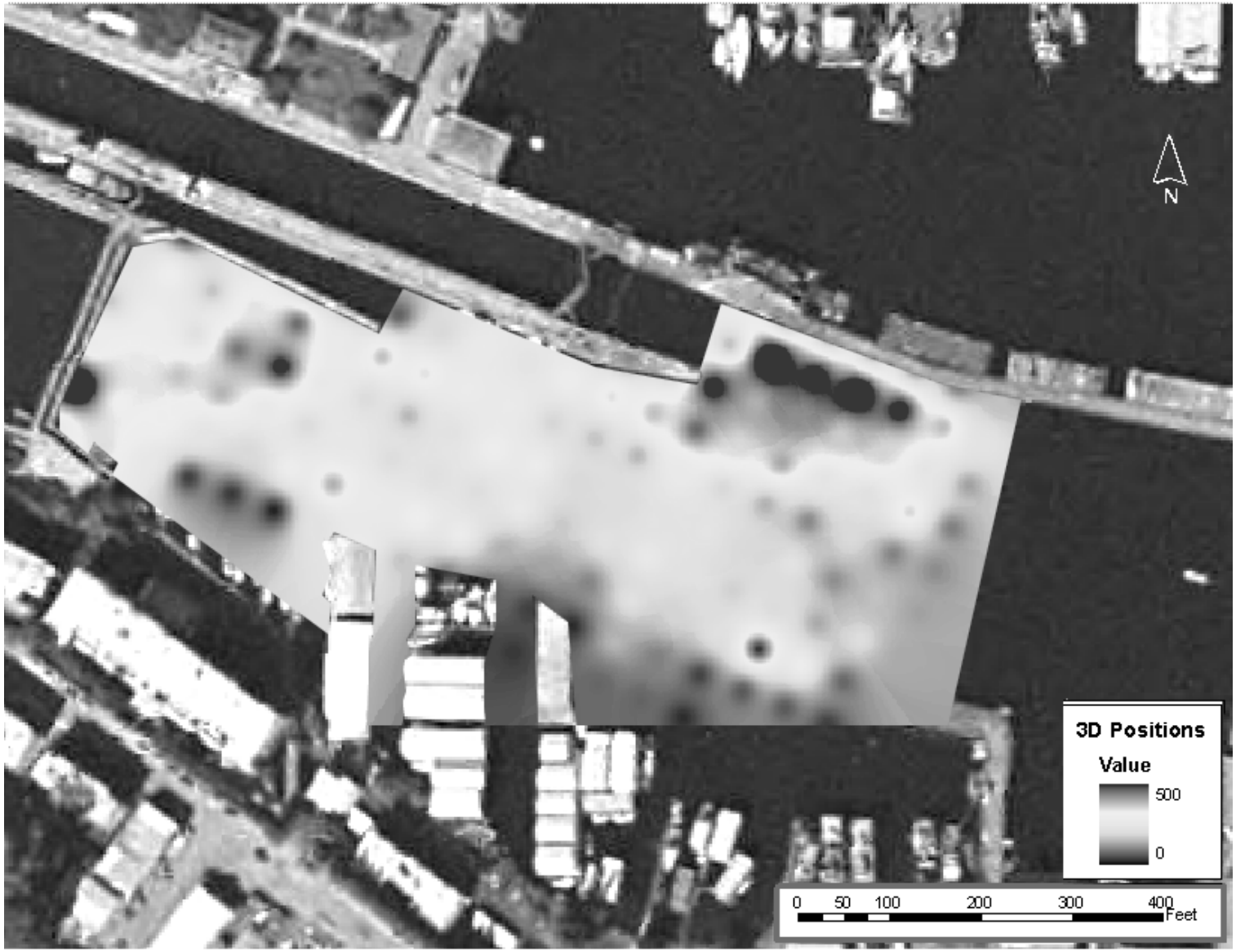
Locks – Vertical Dist. Chinook (Night)



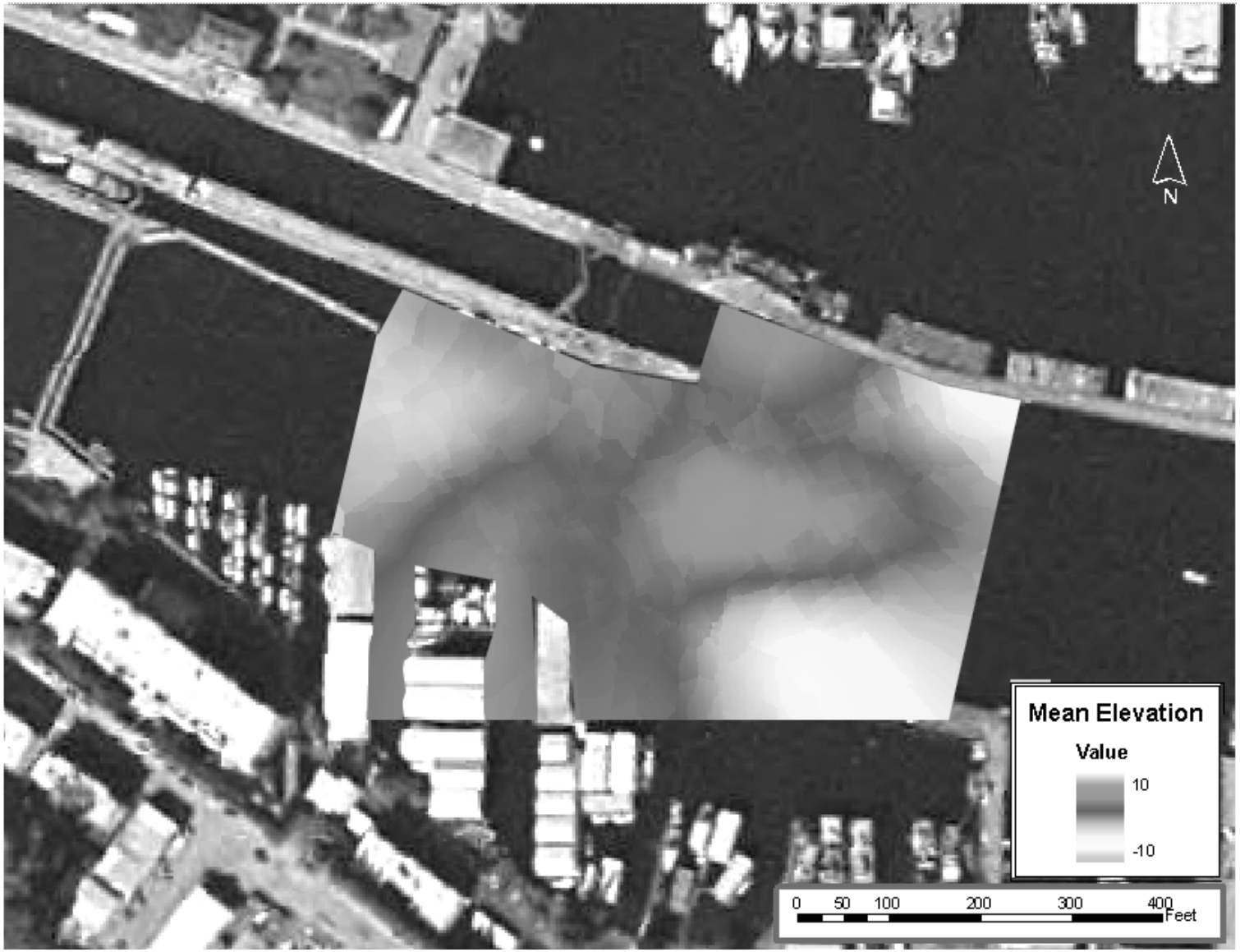
Locks – Coho Positions



Locks – Coho 3D Positions



Locks – Mean Elevations (Coho)



Locks Exit Locations

Species	Large Lock	Small Lock	Flumes	SW Drain	Upstream
Chinook	1	2	1	1	2
Coho	1	1	1	0	1

Travel Time from Locks to Shilshole

		Travel Time (hr)	
Species	N	Mean	Range
Chinook	5	12	4 to 26
Coho	3	11	3 to 26

Conclusions

- Useful but Limited Data Set
- Technology allows for:
  - Tracking Fish in 3D
  - Determining Exit Locations
  - Hypothesis Testing
  - Survival Estimation
  - Integrate Behavioral Data into CFD and NFS models