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Status and Trends of Missouri River Least Terns and Piping Plovers: *How much do we know?*

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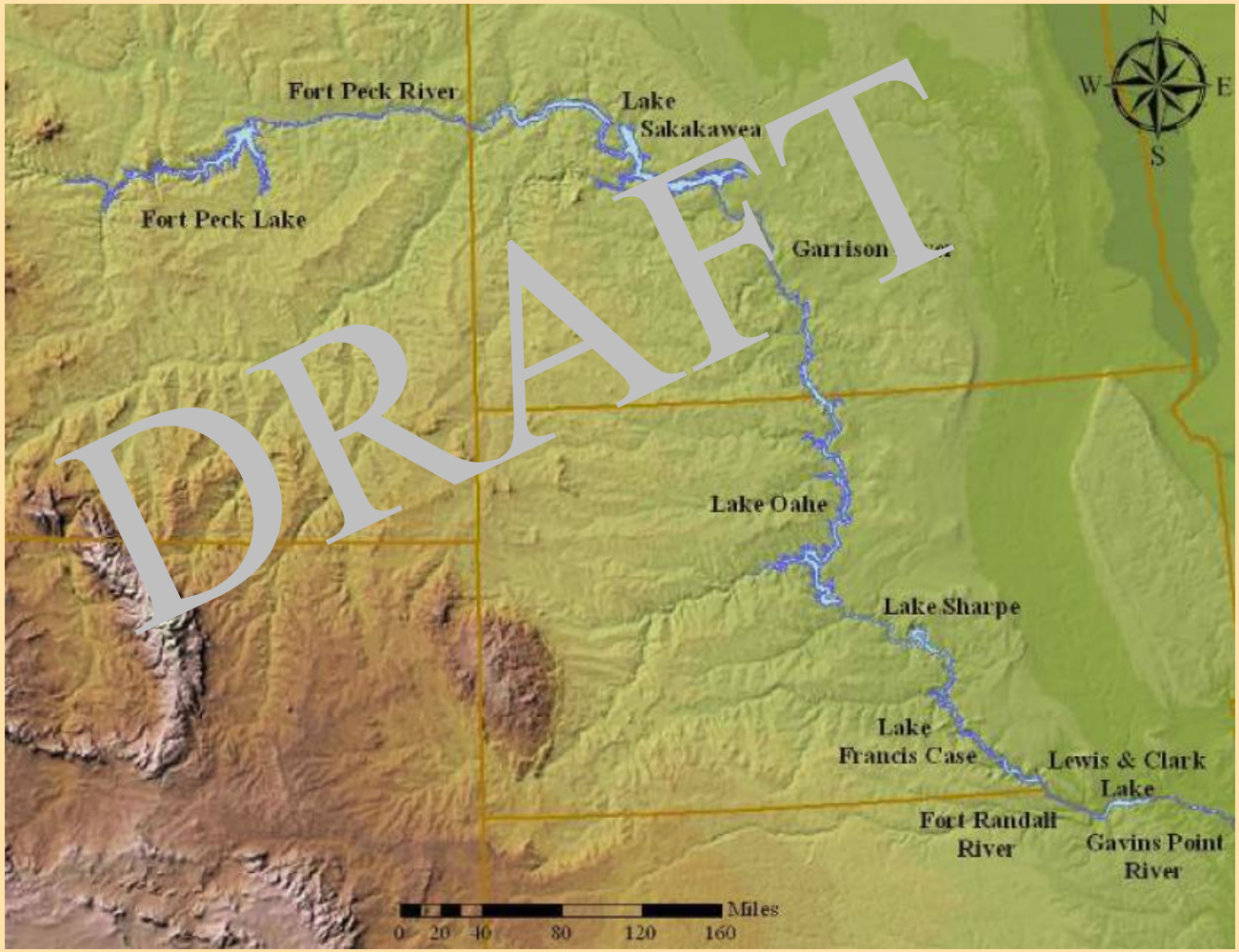
- U.S. Army Corps of Engineers, Omaha District
- U.S. Fish and Wildlife Service
- Virginia Tech

Missouri River System



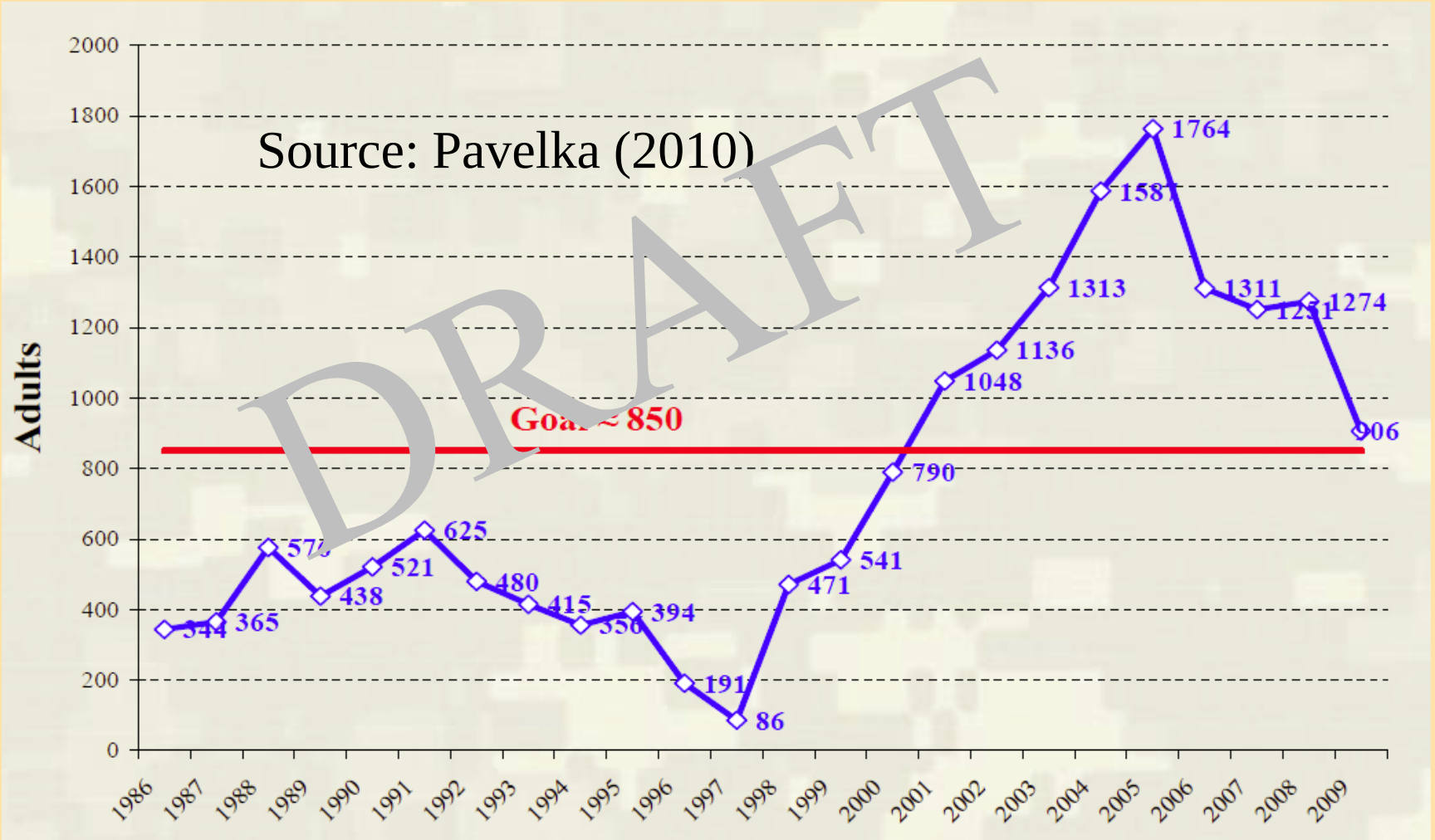
Background

- System-wide surveys of Piping Plovers and Least Terns conducted annually by USACE since 1986
  - Adults
  - Fledged young

System-wide Survey of Adults & Fledglings

- Intended to be a "census"
- Visit all habitat one or more times and enumerate all pairs and all fledglings
- USACE annual monitoring program

Piping Plover Adults –1986-2009



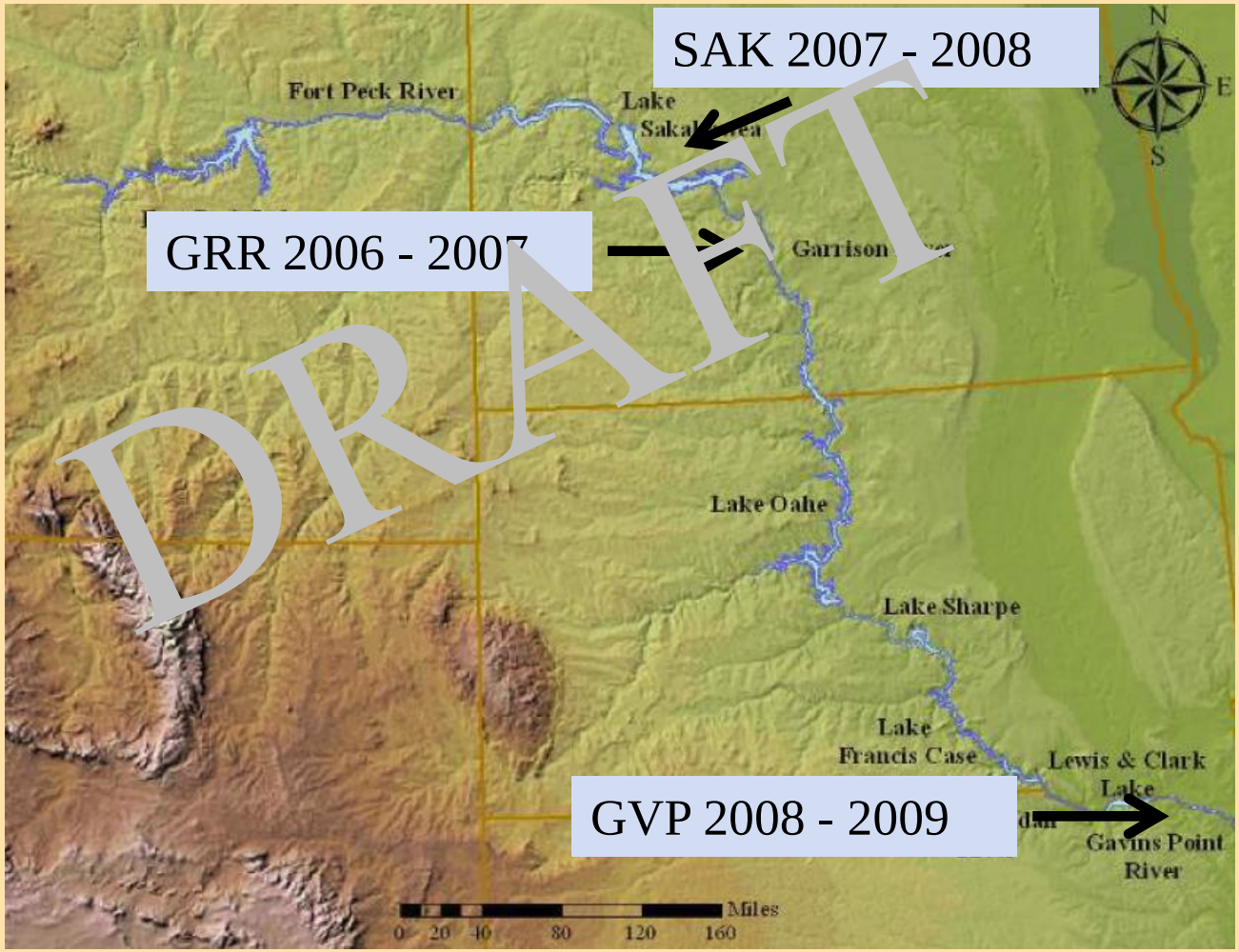
Survey Challenges

- Large & dynamic system
- Suitability of habitat changes year to year
- Highly mobile species
- Breeding seasons of species overlap but are staggered
- Identity of individuals is generally unknown; both under- and over-counting are possible
- Uncertainty over breeding status of adults & flight status of young
- Multiple priorities compete for limited resources

Today's Topic

- Examine accuracy of existing surveys on three study reaches, 2006-2009
- Discuss potential uses of survey results and identify data limitations

Study Reaches



Double Sampling Study

Low Intensity

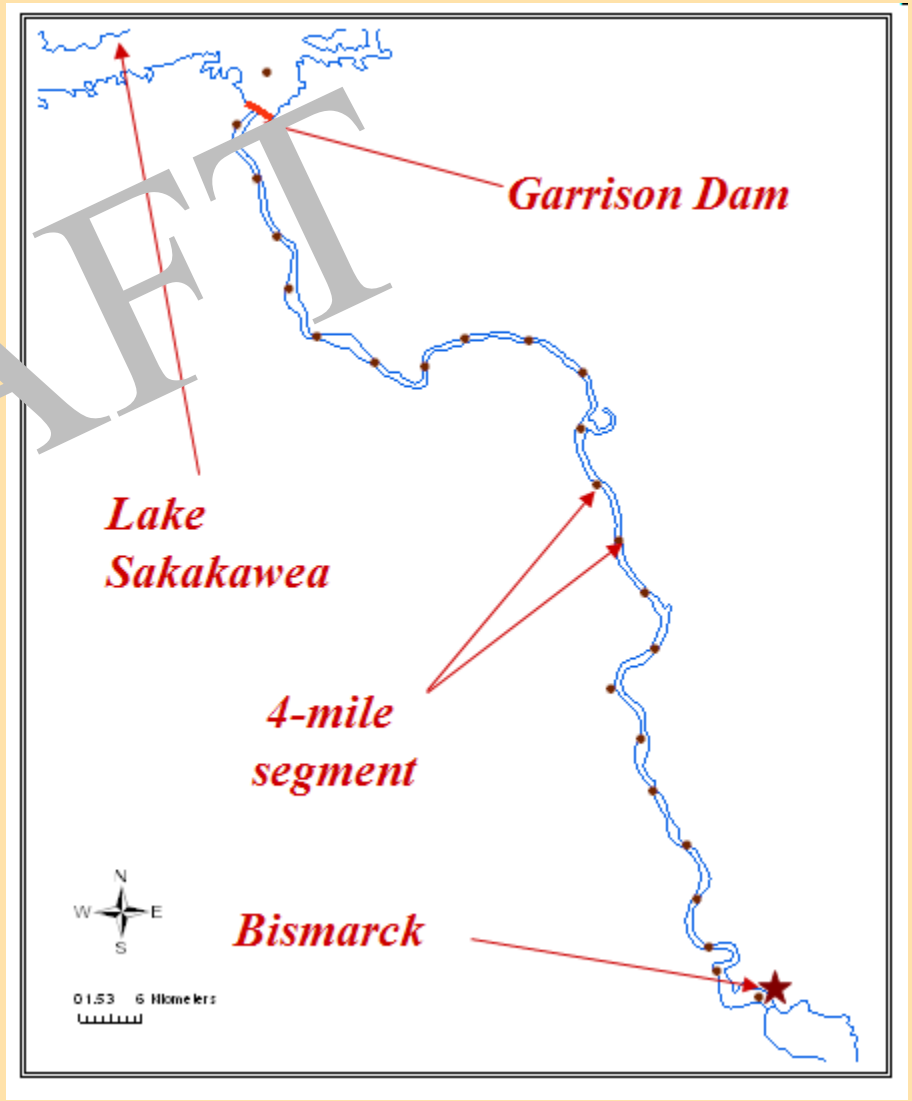
- Established Army Corps monitoring program
- High institutional knowledge of historical nesting areas
- Later start date
- 7- to 10-day return interval for nests and chicks
- Fewer crews
- No sampling design
- Single annual adult survey
- "Unmarked" fledglings

High Intensity

- New USGS research program
- Little institutional knowledge of historical nesting areas
- Earlier start date
- 2- to 3-day return interval for nests and chicks
- More crews
- Stratified random sampling design
- Weekly adult survey
- Marked fledglings

USGS Study Design – Garrison Reach

- Study area consisted of 21 4-RM segments.
- Each segment assigned to high, medium, or low stratum based on past (2000-2005) use by nesting terns or plovers.
- Stratified random sample of 17 segments for nest and fledgling counts.
- 100% of high-use segments selected.
- Weekly adult survey for all 21 segments.



Study Design – Lake Sakakawea

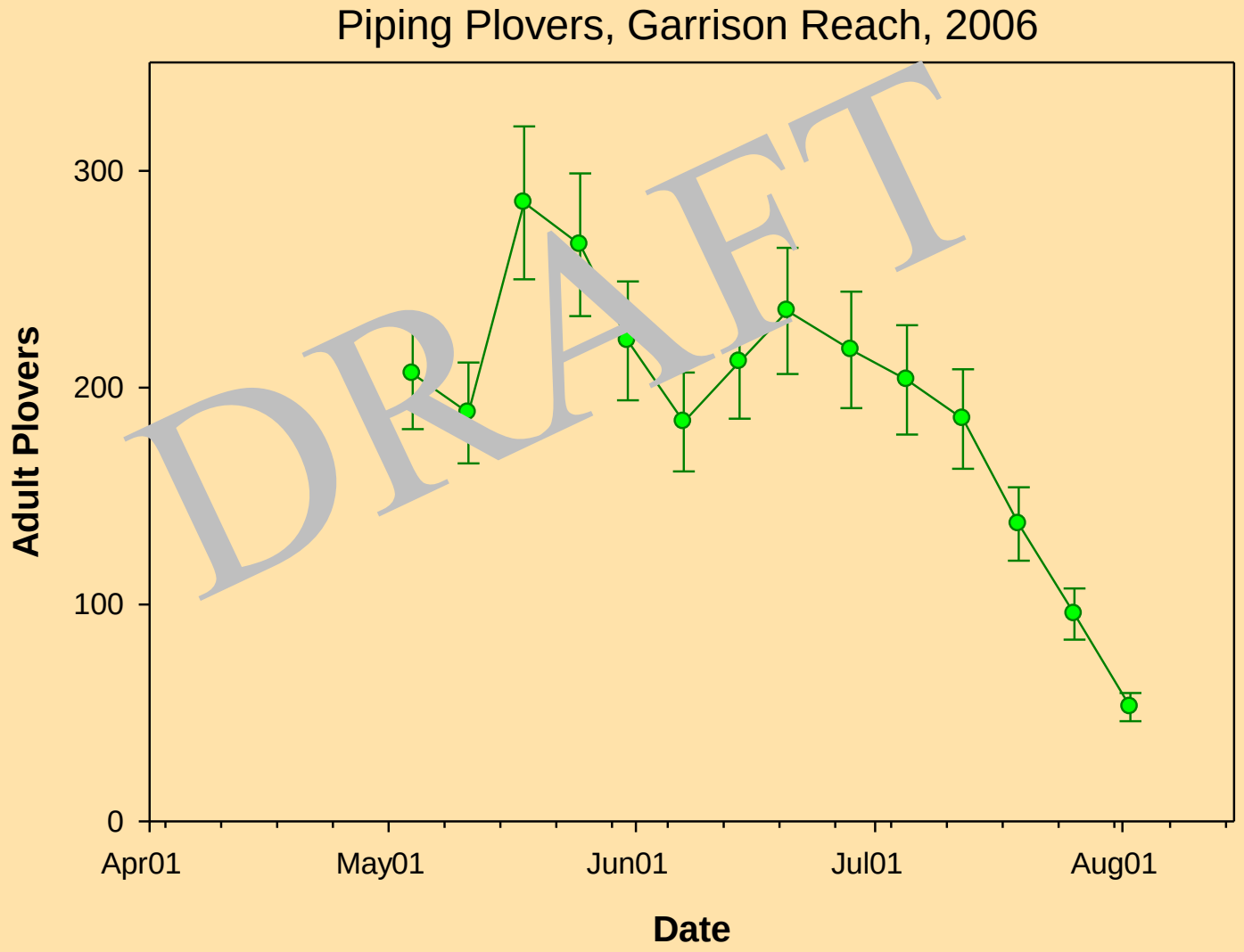
Quantifying Adult Abundance

- 2 data sources
  - Adult counts corrected for detectability
  - Nest counts from intensive nest surveys

Adult Abundance (High Intensity Surveys)

- Weekly count of adults on entire survey reach
- Completed in 1 day
- Counts corrected for non-detection via a double-sampling design

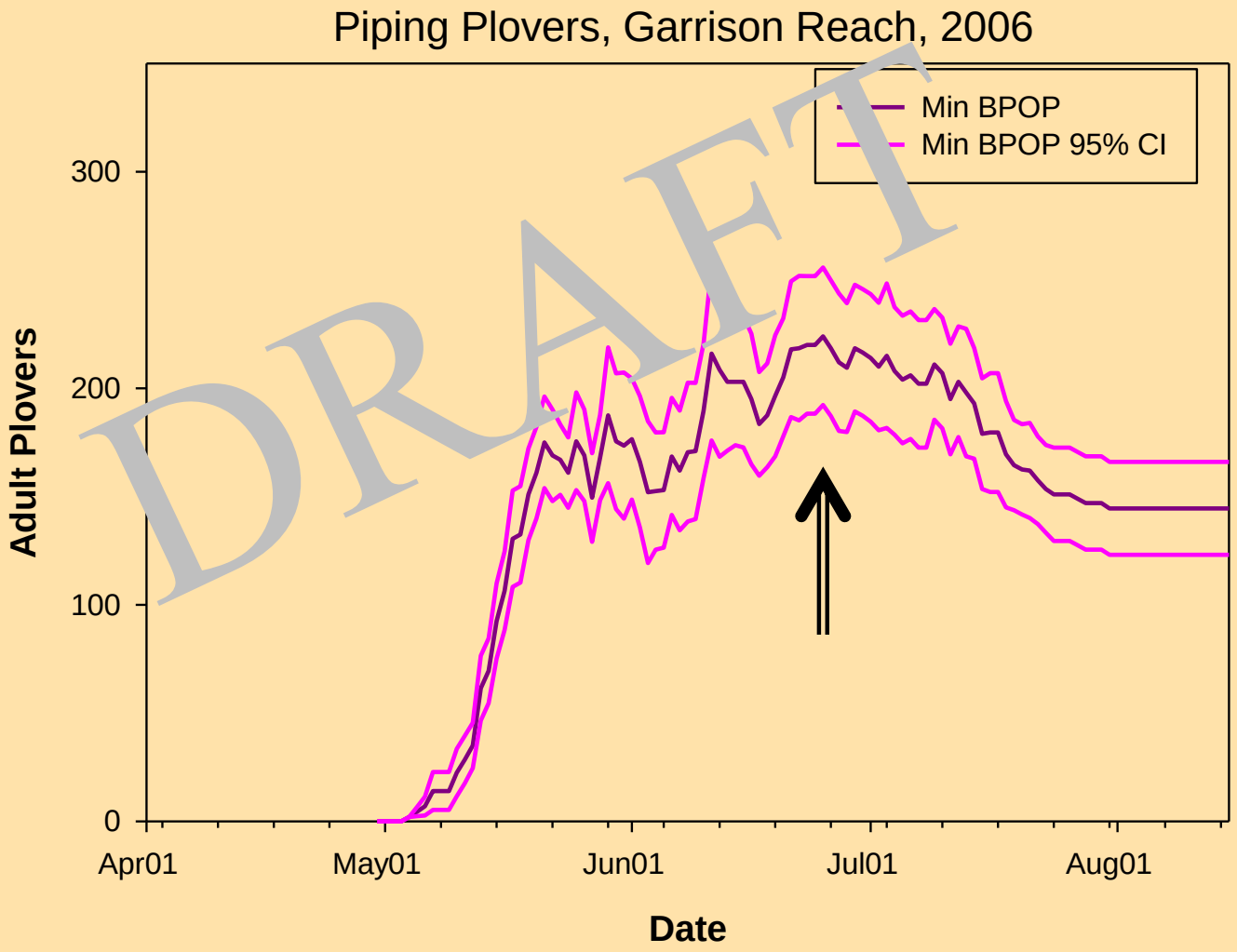
High-intensive Adult Survey Example



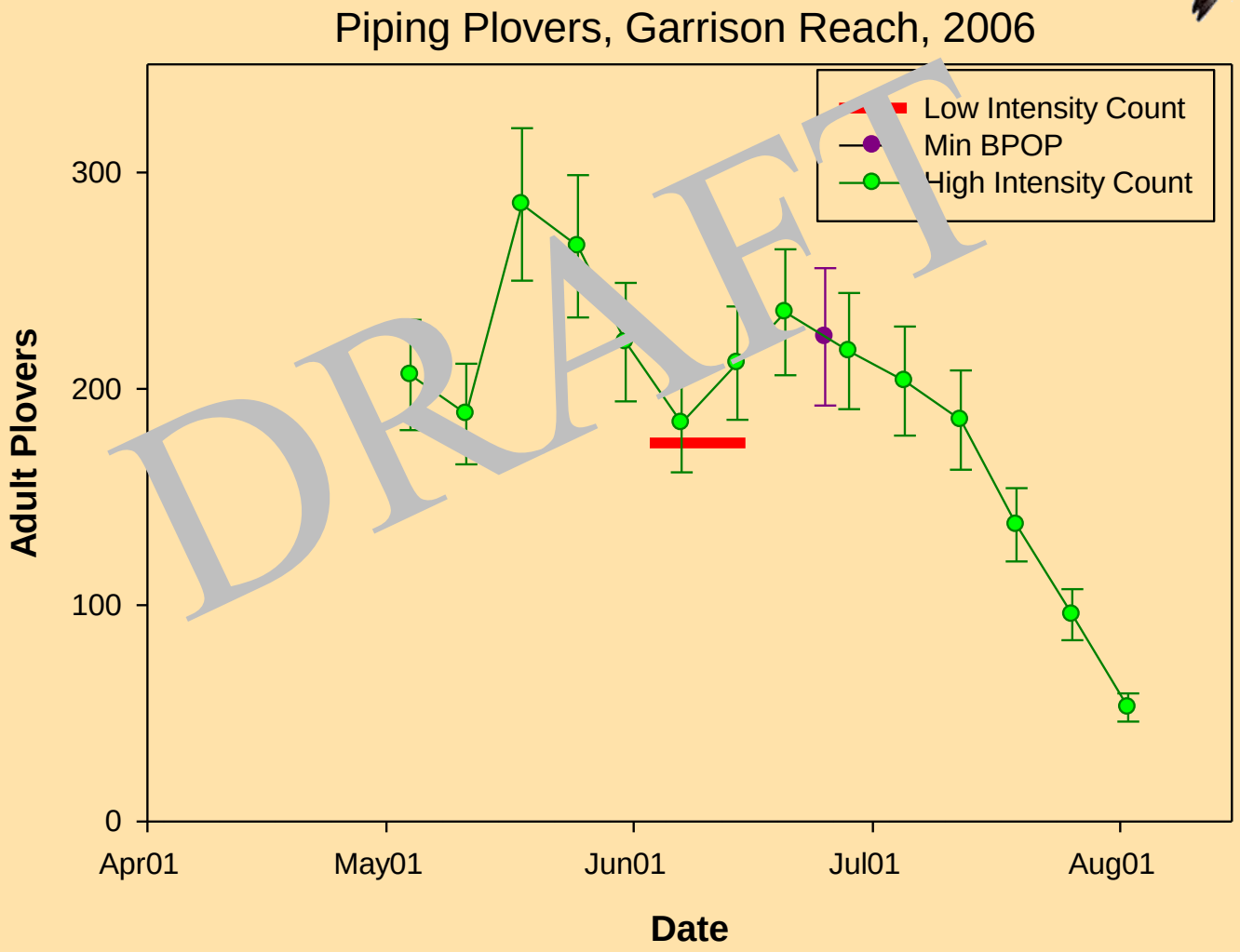
Minimum Breeding Population (MINBPOP)

- Adults that attempt ≥1 nest; does not equal adults
- Daily estimates from nesting data:
  - Active nests
  - Successful nests
  - Recently failed nests
- "Nests" = indicated pairs
- MINBPOP = 2 * Pairs
- Minimum estimate

Minimum BPOP Example



Results: Plover Adults (+/- 95% CI)



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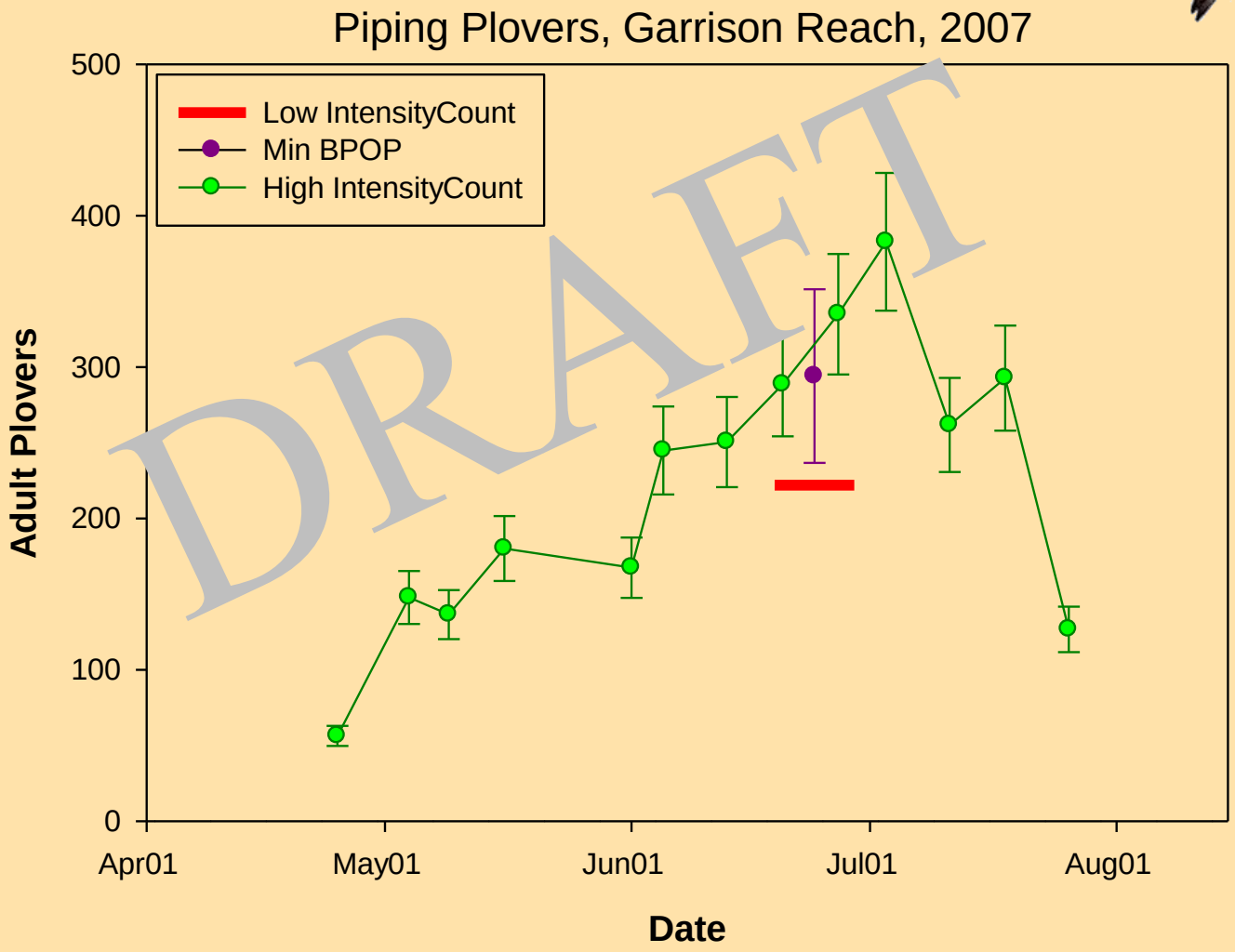

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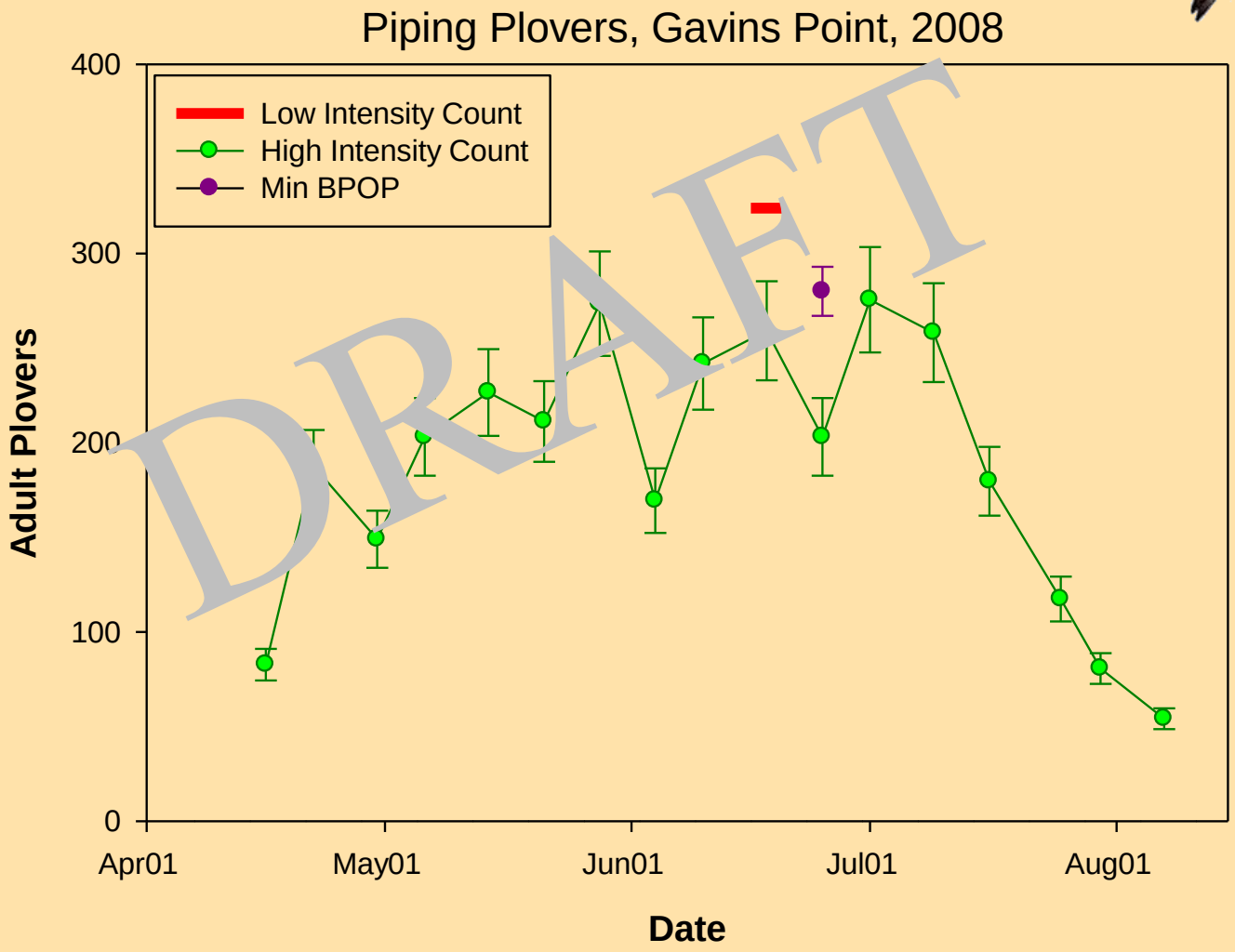

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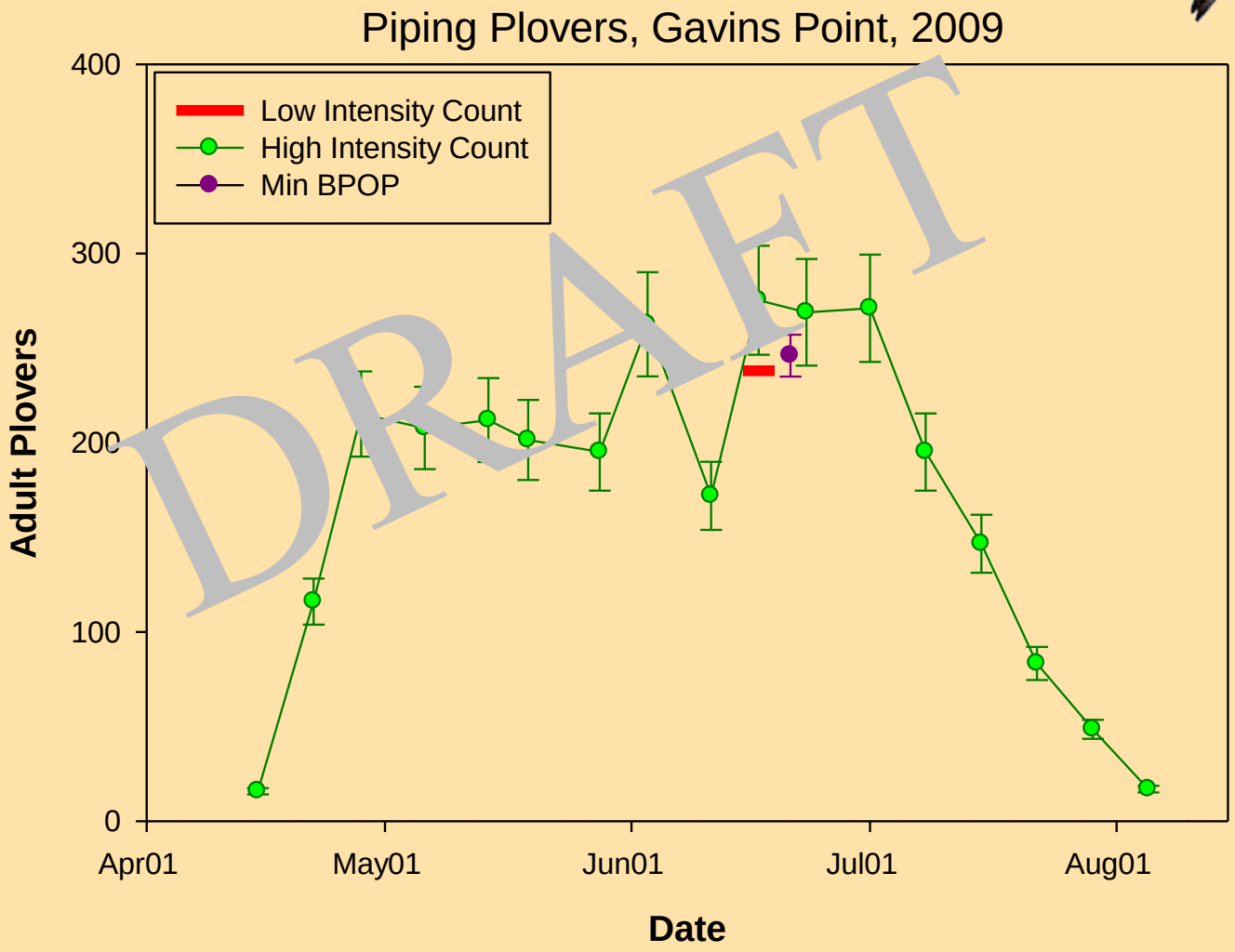

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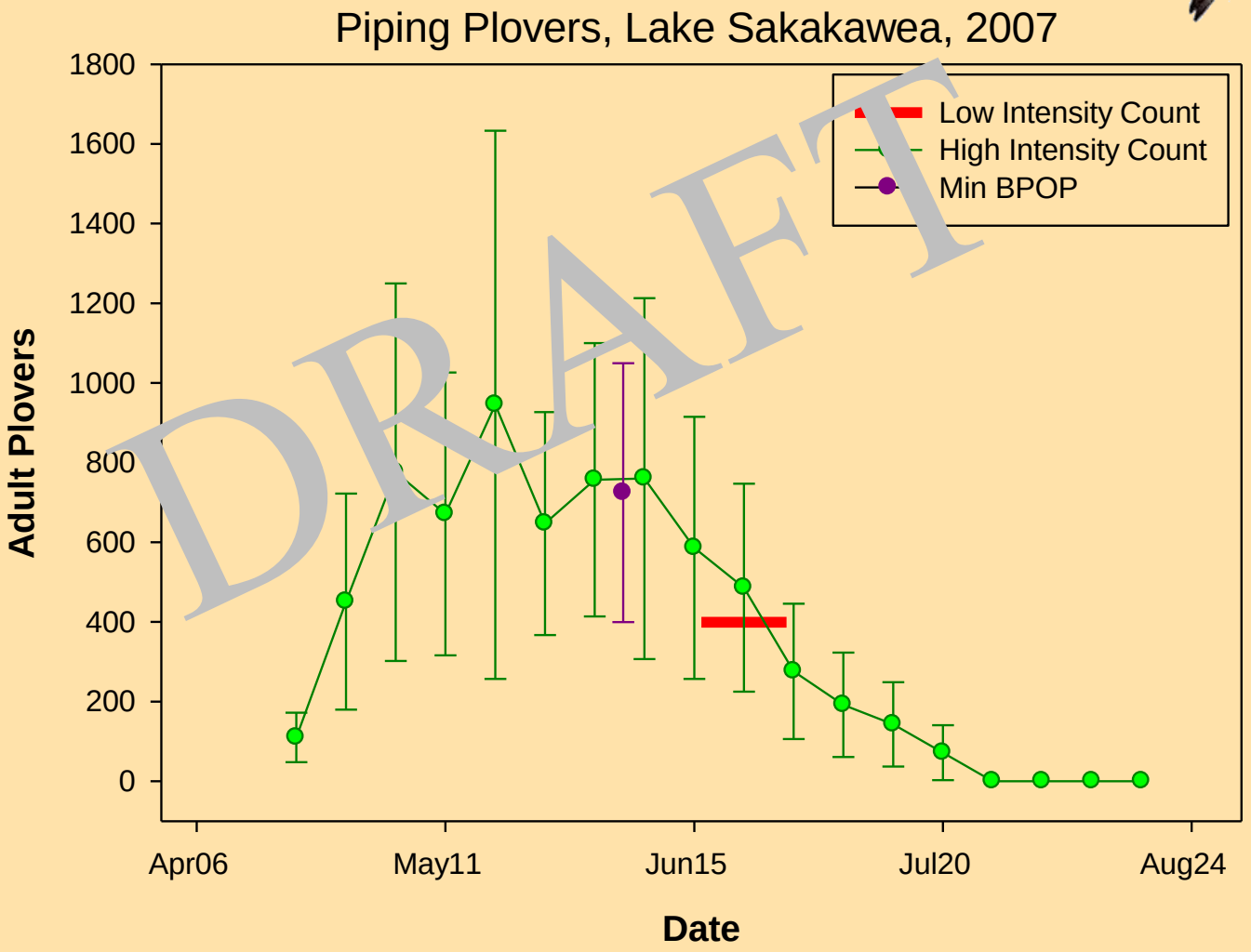

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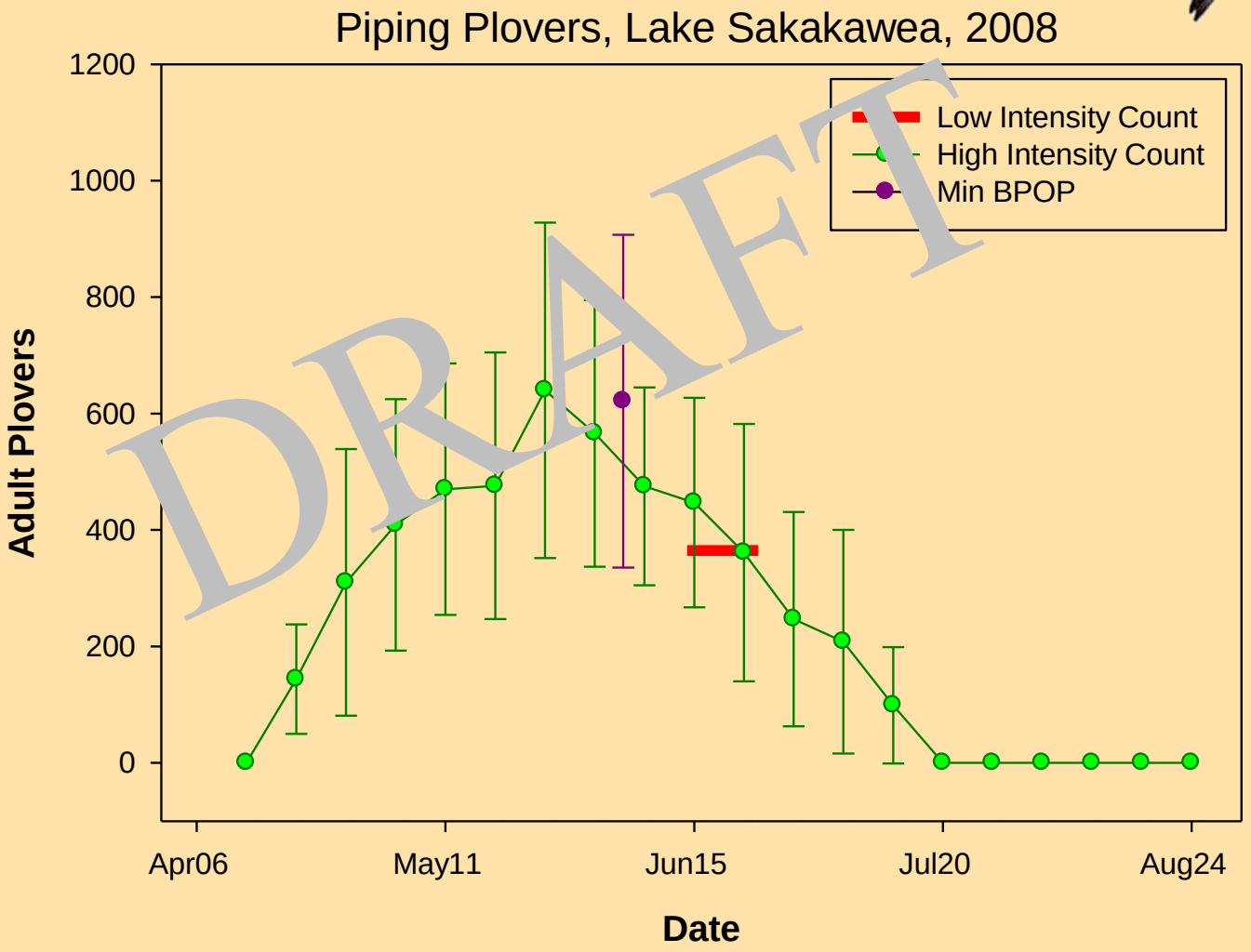
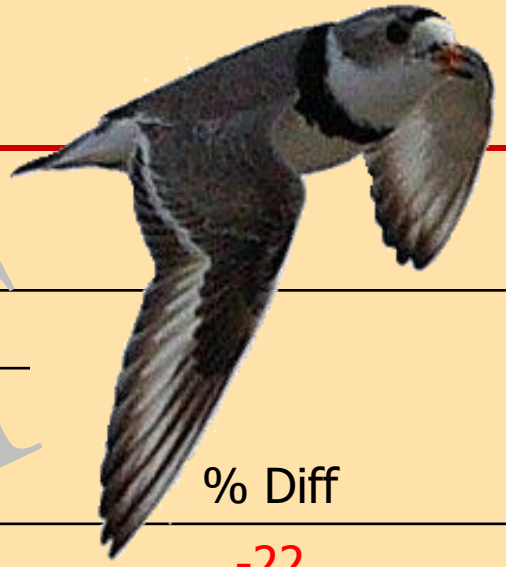
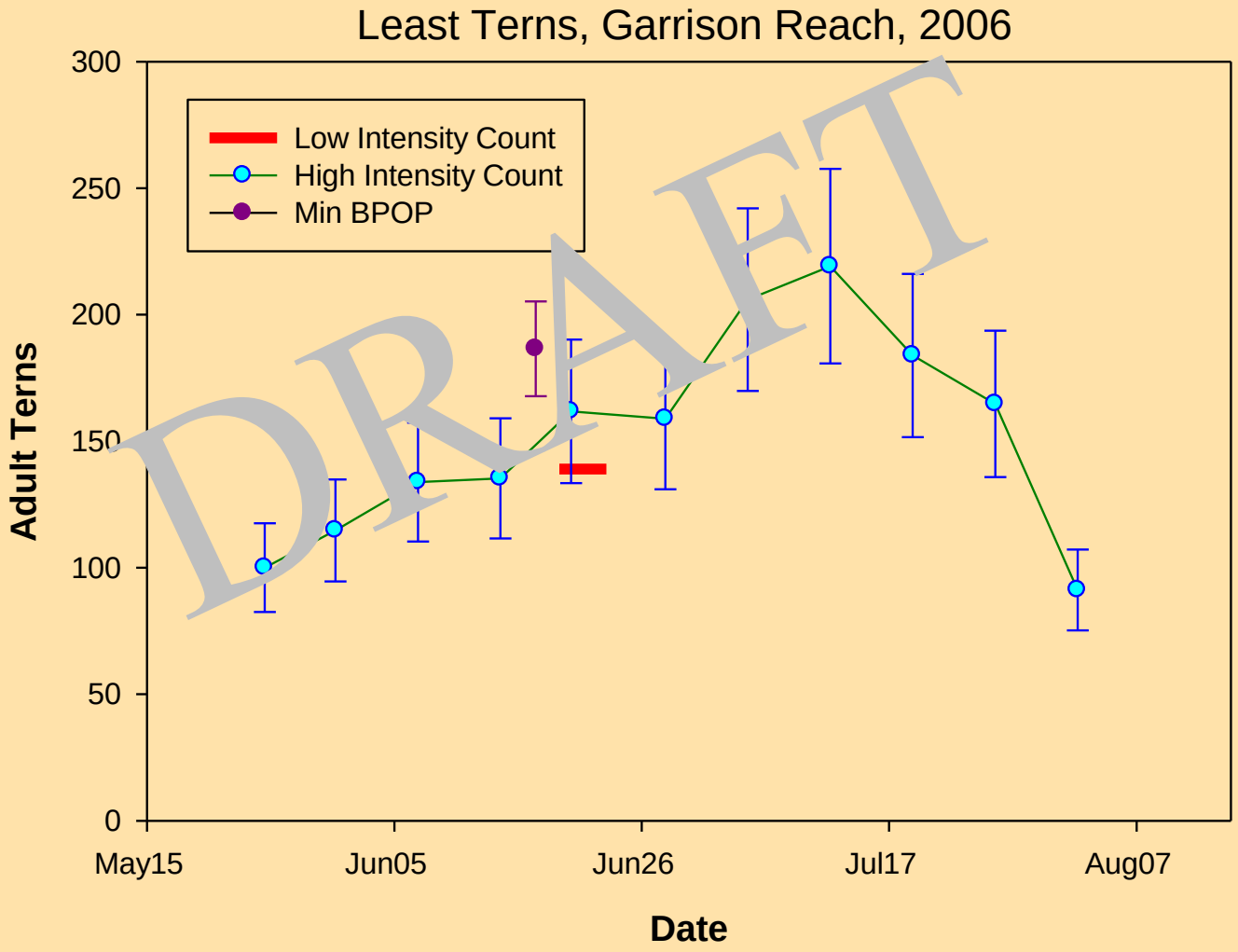


Summary: Adult Plovers

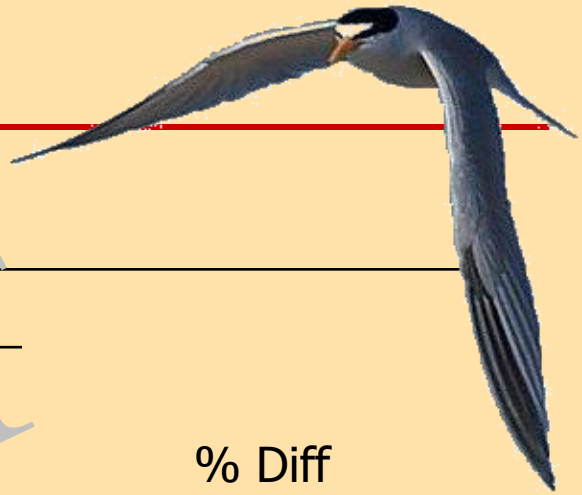


		Intensity		
		Low (USACE)	High (USGS)	% Diff
Garrison	2006	175	224	-22
	2007	232	294	-24
Gavins Point	2008	324	280	16
	2009	238	246	-3
SAK	2006	430	943	-54
	2007	399	725	-45
	2008	365	621	-41
	2009	85	498	-83

Example Results: Least Tern Adults



Summary: Adult Terns



		Intensity		
		Low (USACE)	High (USGS)	% Diff
Garrison	2006	139	187	-26
	2007	143	179	-31
Gavins Point	2008	278	310	-10
	2009	211	249	-13

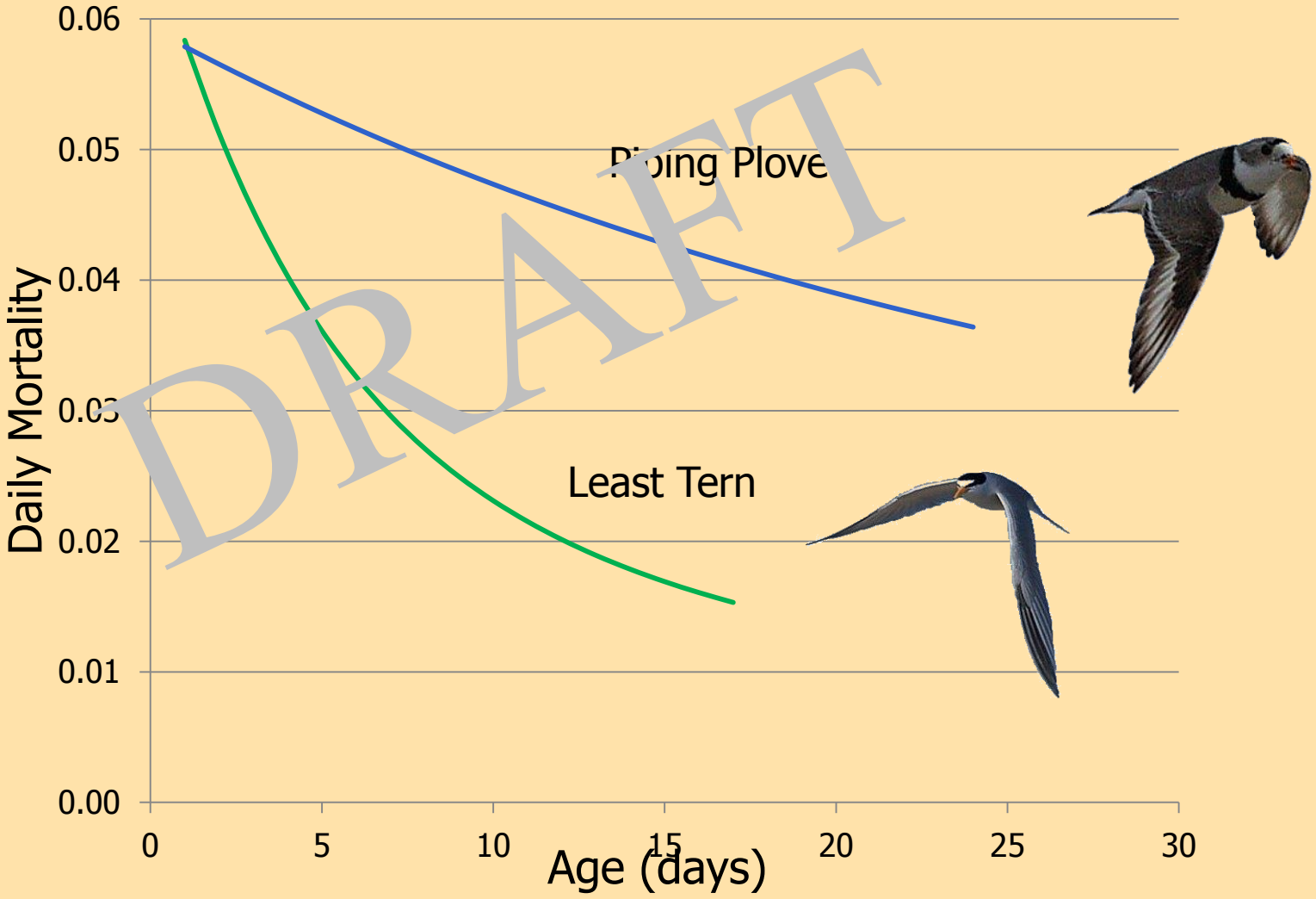
Quantifying Fledged Young

- 2 data sources
  - Mark-recapture of individually marked chicks (1318 plover, 1635 terns)
    - Detection probability
    - Survival rate
  - Minimum and maximum counts of hatchlings
    - No. chicks banded
    - No. eggs that could have hatched

Estimating Fledged Young: 1st Approach

- Counts of individually marked chicks that reached 21 days (plovers) or 16 days of age (terns), corrected for detectability
- Assumption:
  - Mortality of 20+ day-old chicks is negligible

Daily Mortality vs. Chick Age



Detection of Fledging-age Chicks

	Detection probability	
	Piping Plover	Least Tern
Garrison River	0.91	0.68
Gavins Point River	0.74	0.65
Lake Sakakawea	0.97	NA

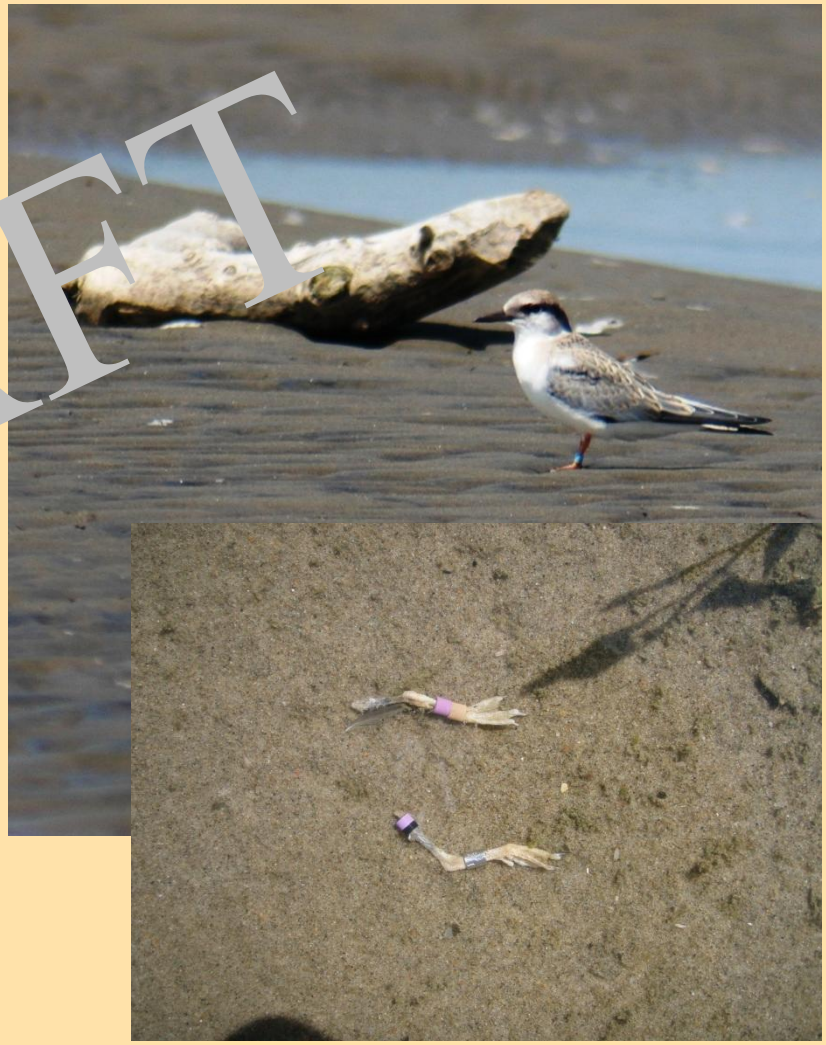
Roche et al.

Do you see what I see? Detecting Least Tern and Piping Plover fledglings on the Missouri River.

Saturday, March 12 in Kearney

Estimating Fledged Young: 2nd Approach

- Number of hatchlings × probability of surviving to age 21 (16 for terns)
  - Lower Bound – Number of chicks banded
  - Upper Bound – Number of eggs that hatched or could have hatched
- Assumption:
  - Mortality of 20+ day-old chicks is negligible



Survival from Hatch to Fledge

	Survival Probability	
	Piping Plover (30 days)	Least Tern (15 days)
Garrison River	0.42	0.65
Gavins Point River	0.37	0.55
Lake Sakakawea	0.31	NA

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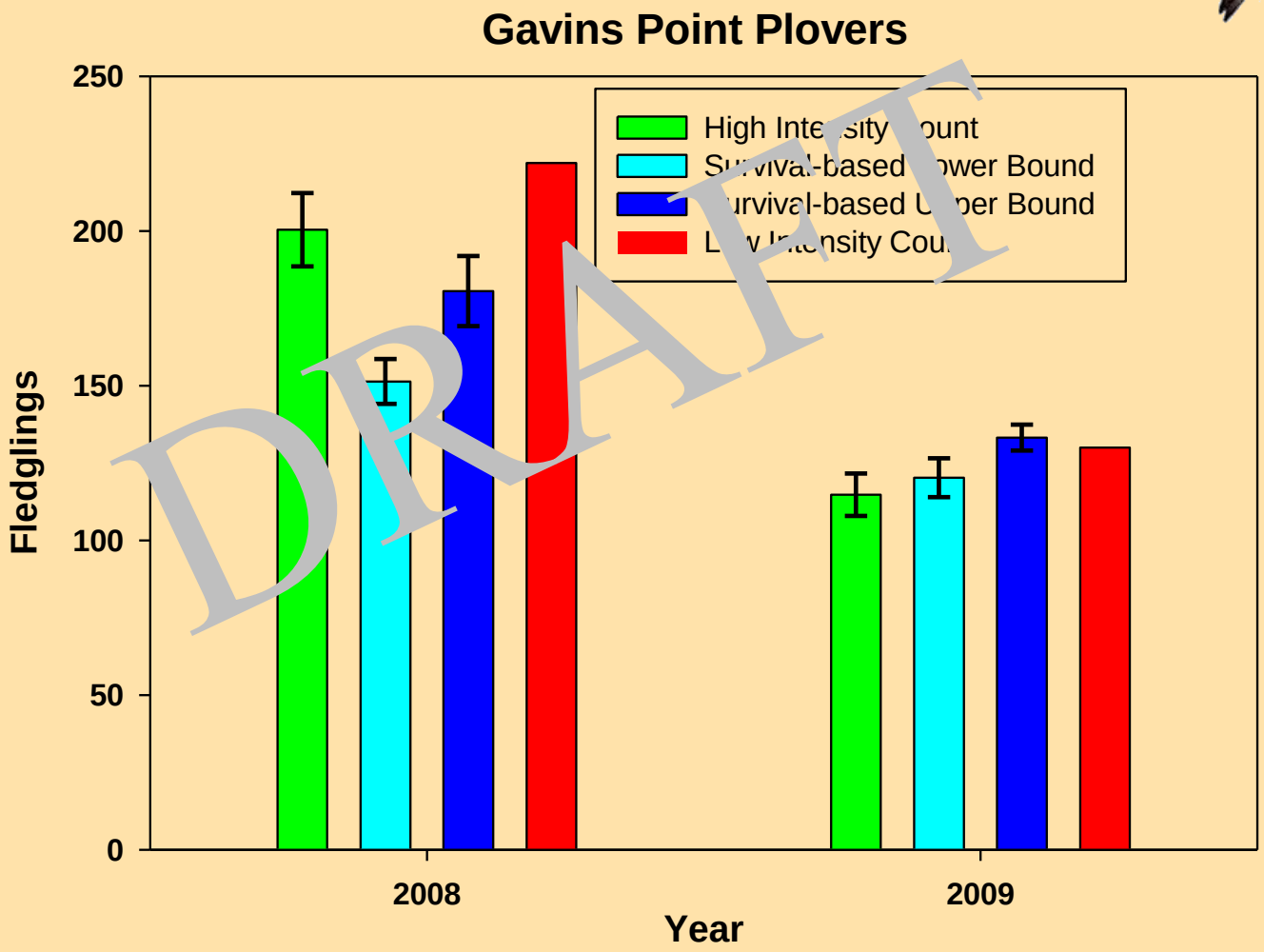
Example Results: Plover Fledglings



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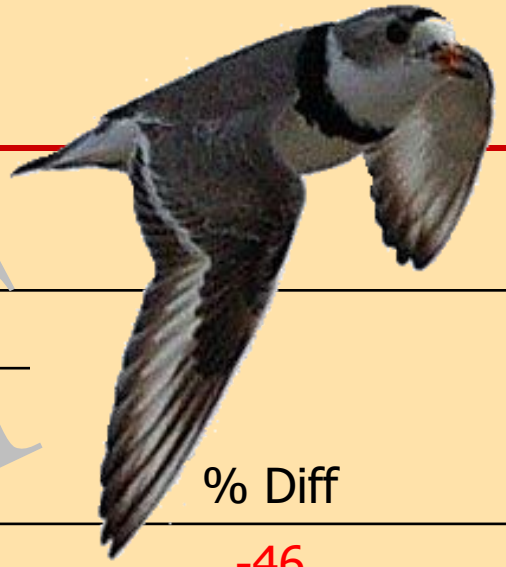
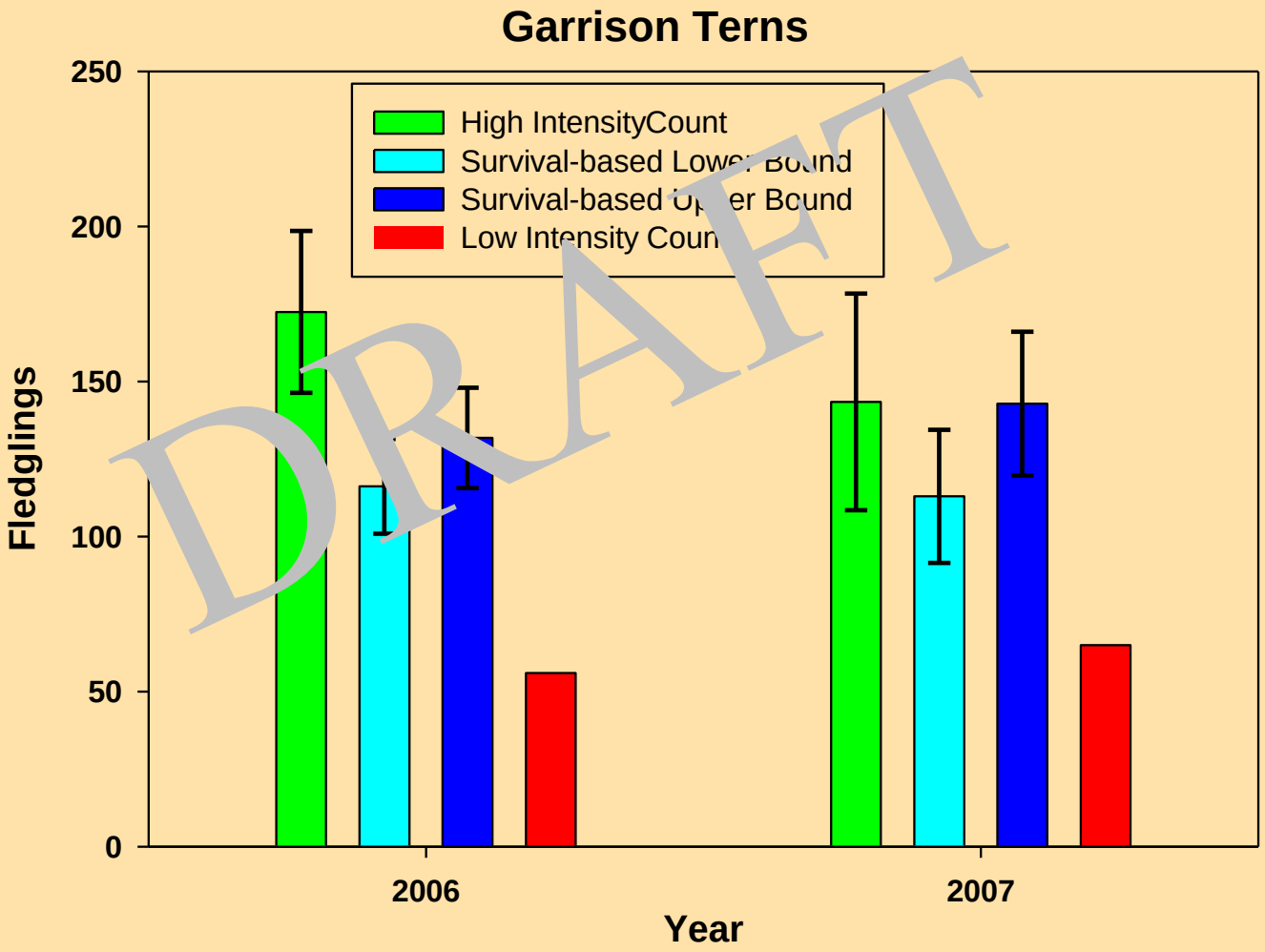
Summary: Fledgling Plovers

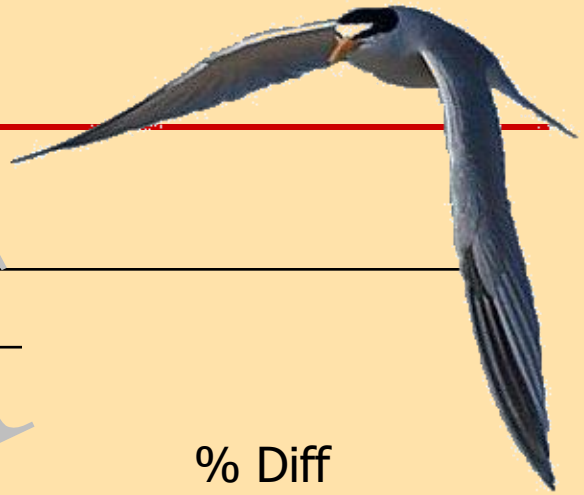


		Intensity		
		Low (USACE)	High (USGS)	% Diff
Garrison	2006	67	125	-46
	2007	108	218	-50
Gavins Point	2008	222	200	11
	2009	130	115	13
SAK	2007	140	221	-33
	2008	124	123	-30

Example Results: Least Tern Fledglings



Summary: Fledgling Terns



		Intensity		
		Low (USACE)	High (USGS)	% Diff
Garrison	2006	56	172	-68
	2007	65	143	-55
Gavins Point	2008	159	236	-33
	2009	105	150	-30

Observations

- Degree of bias differed among study areas
- Less bias in fledgling counts than adult counts, except at SAK where they were similar
- USGS data for adults based on <u>minimum</u> breeding population and thus…
- Bias in adult counts also regarded as a minimum

Why the differences among study areas?

- Possible mechanisms
  - Larger areas to "census" at SAK
  - Substrate differs between river and reservoir habitats; birds may be more difficult to spot on reservoir shorelines
  - Nesting more concentrated on Gavins than Garrison
  - Allocation of effort
- We do not know mechanisms

Why Monitor Adults?

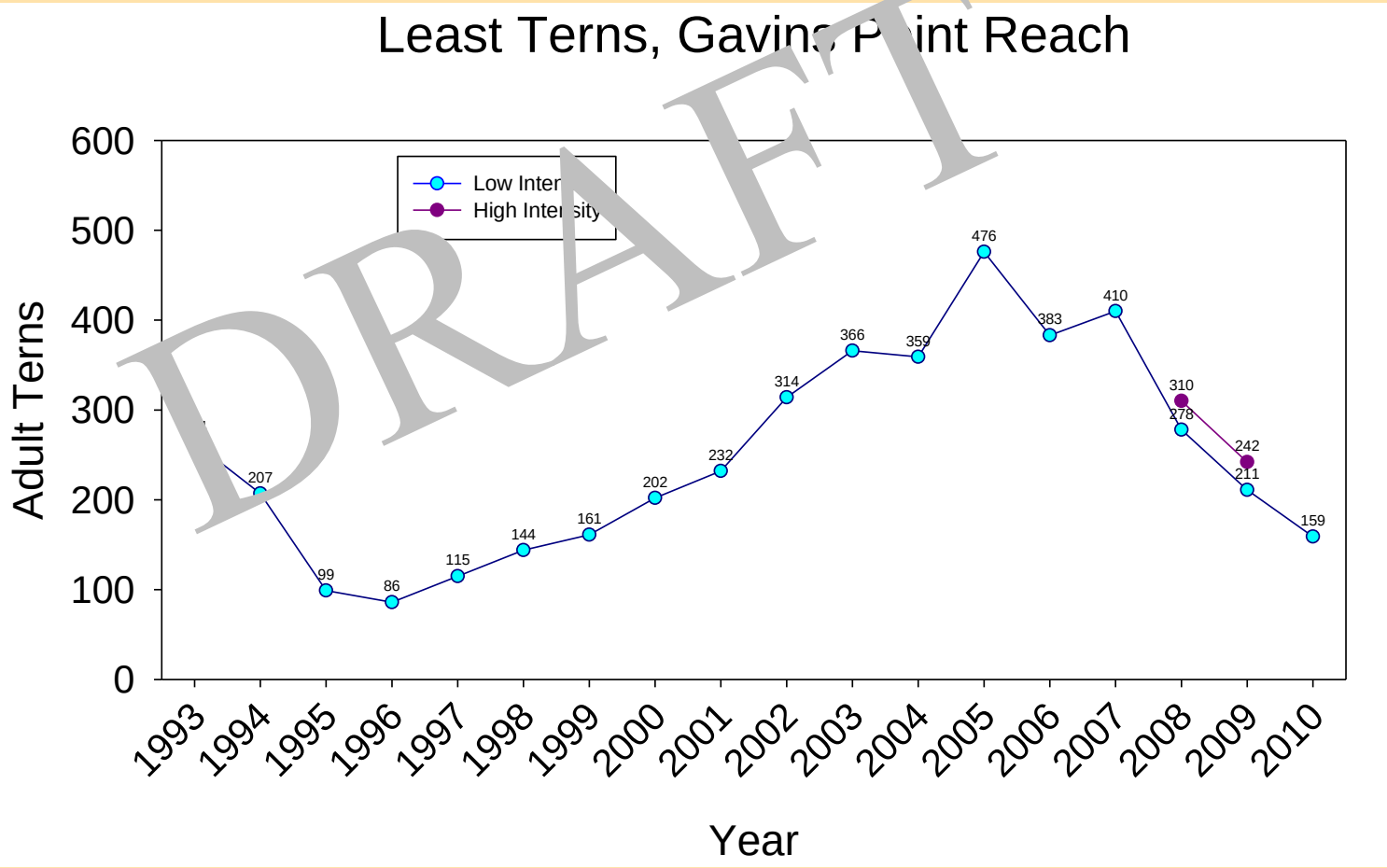
- Determine abundance
- Identify trends in abundance and distribution
- Identify important habitats
- Guide management decisions
- Set recovery goals
- Assess progress towards recovery

Why Monitor Fledglings?

- Identify threats to survival
- Guide management decisions
- Measure of annual productivity
- Are recovery goals being met?

Status and Trends: *How much do we know?*

- Do we know abundance?



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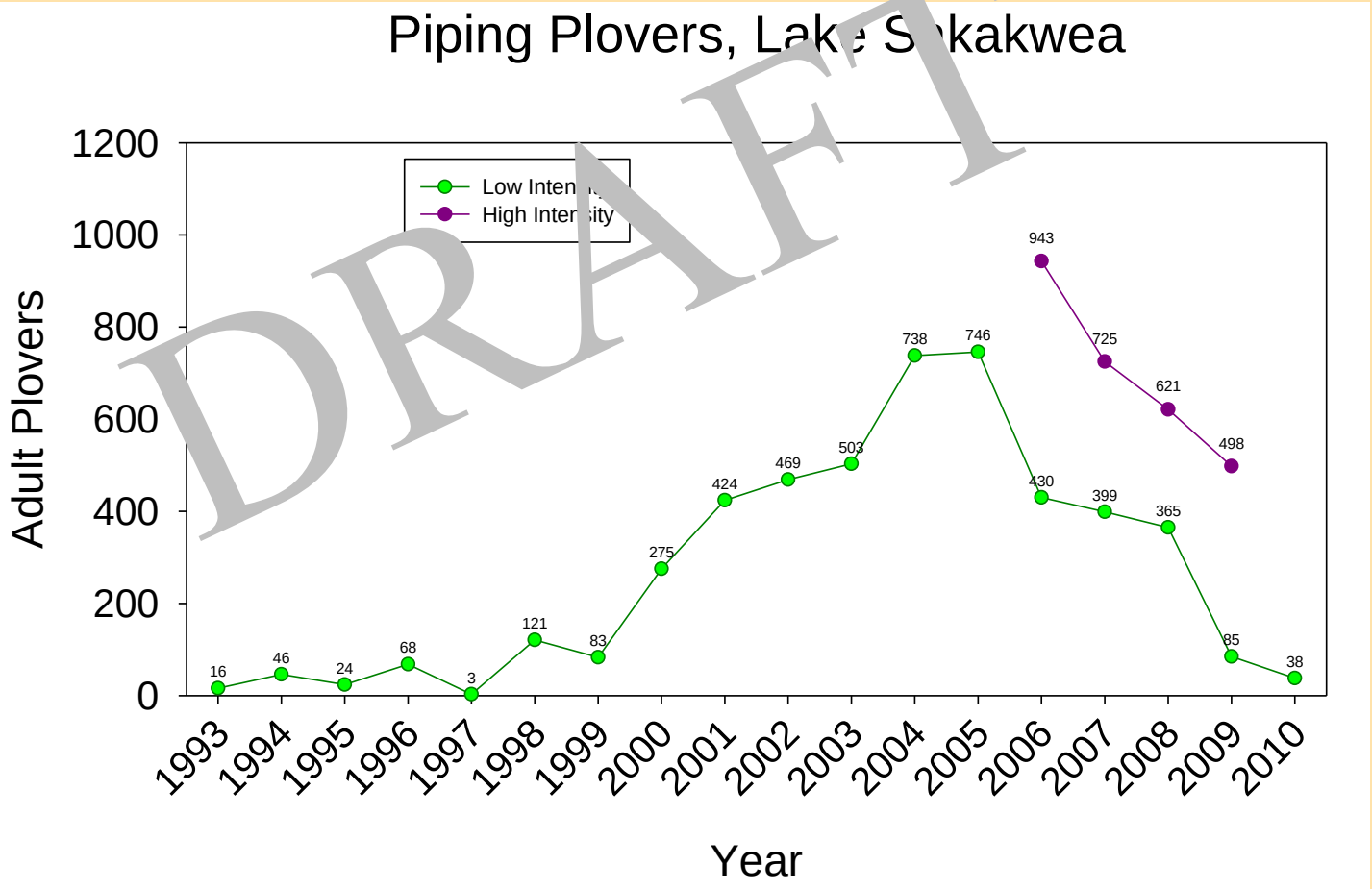

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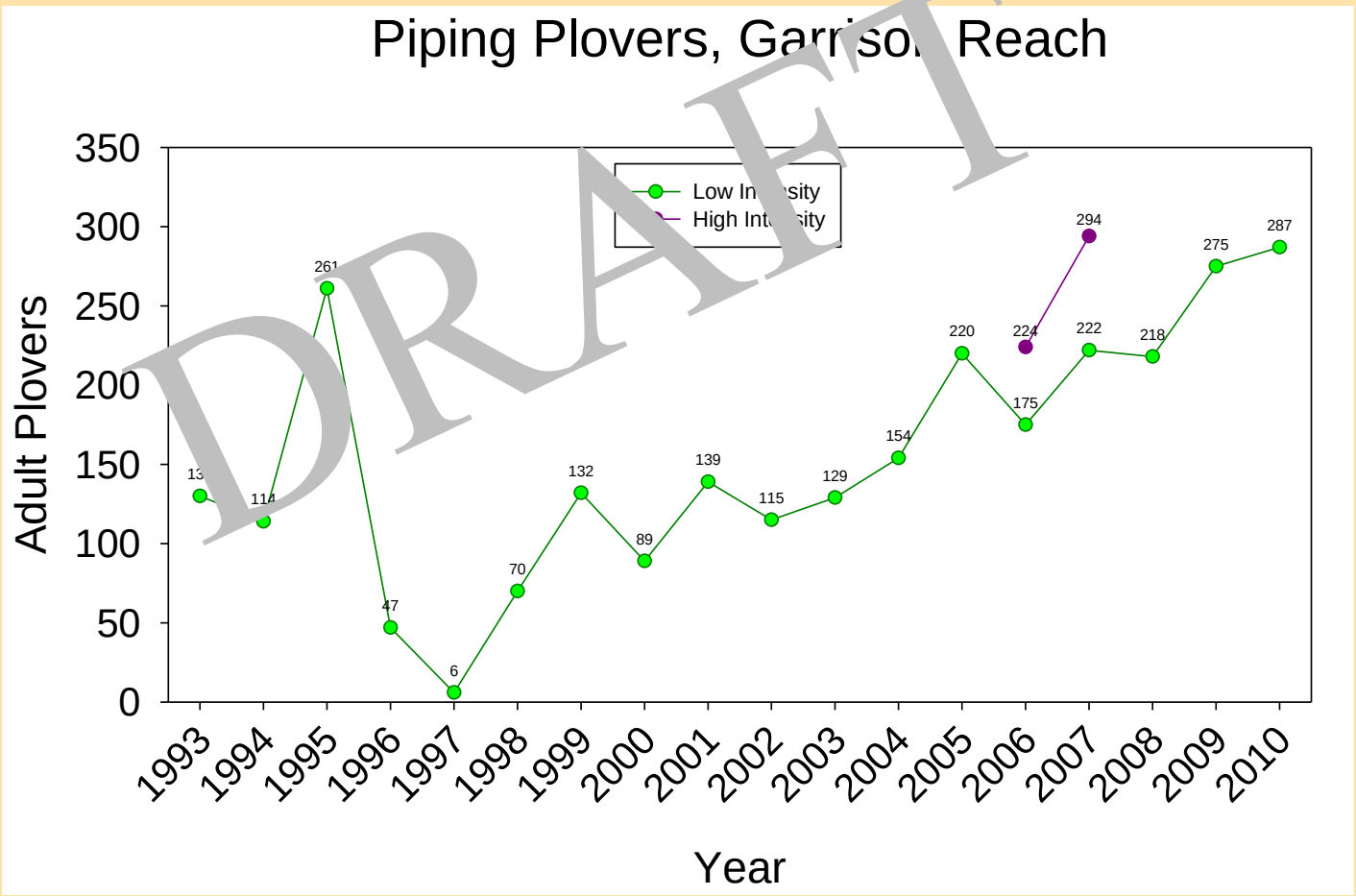

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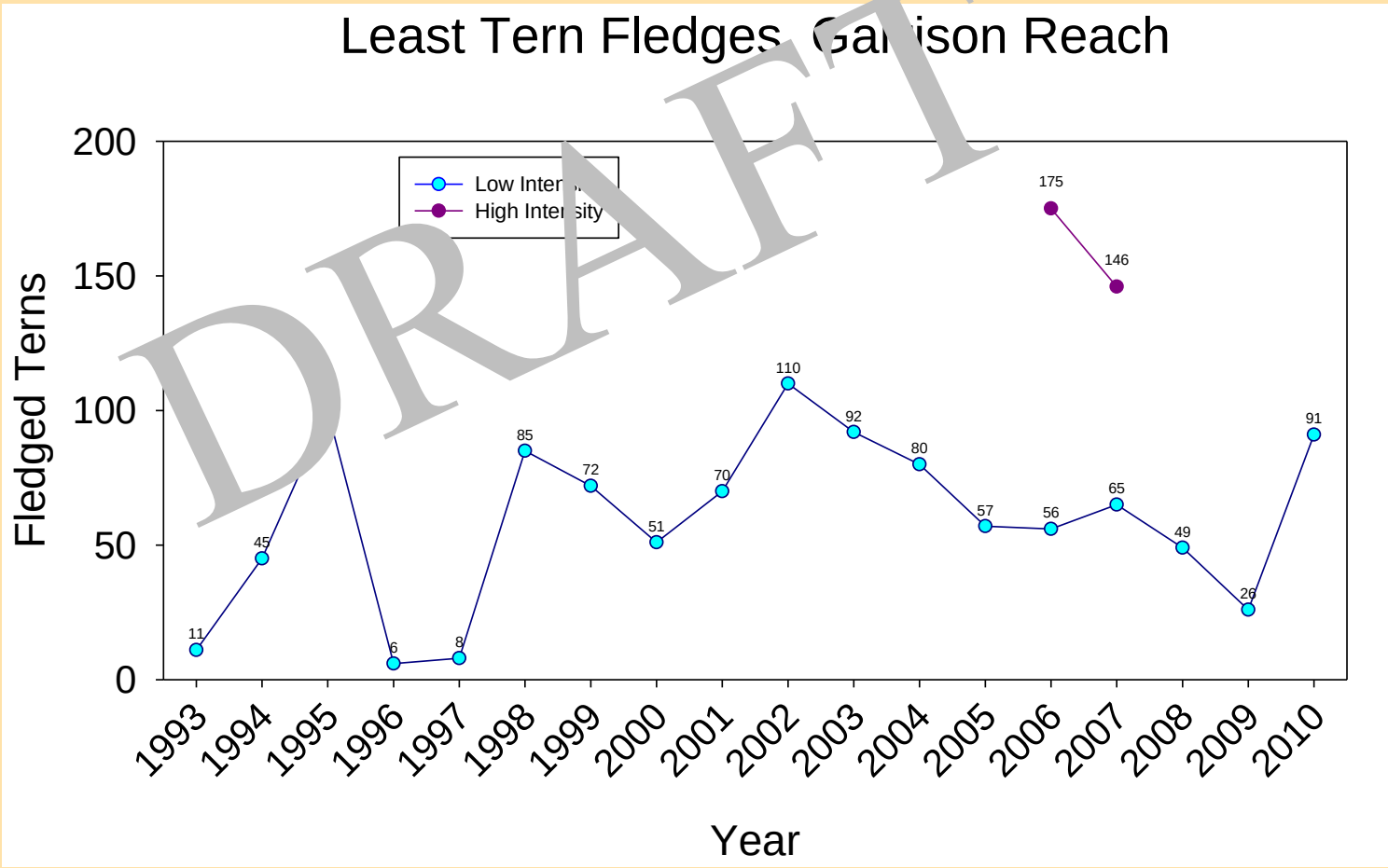

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Status and Trends of MO River Terns and Plovers

- Do we know enough?
  - Linked to objectives, needs, and priorities
- How can we know more?