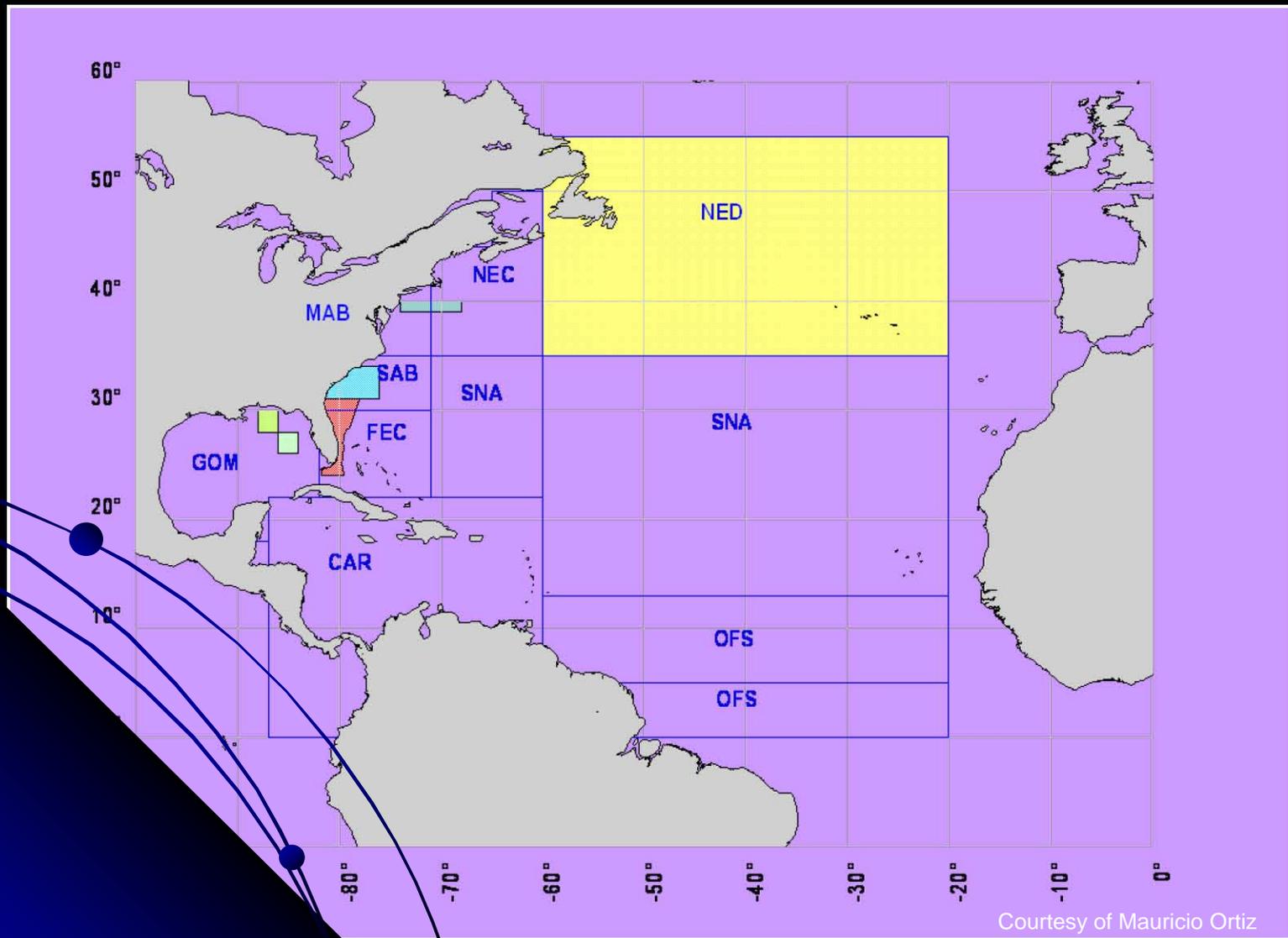


Western Atlantic Pelagic Longline Sea Turtle Mitigation Research 2001 - 2003

John Watson, Dan Foster, Sheryan Epperly,
Arvind Shah



Geographical distribution of the US Atlantic Pelagic Longline fishery



2001 Experiments

- Controls were natural squid on 8/0, 9/0, or 10/0 J-hooks (25°-30° offset) and a branch line directly under every float.
- Treatments
 - Blue-dyed Squid bait
 - Move branch line 20 fathoms away from every float
 - Investigate variables which may affect turtle interactions

2002 Experiments

- Controls were natural squid on 9/0 J-hooks (25° - 30° offset).
- Treatments
 - Reduce daylight hook soak time
 - 18/0 circle hooks (non offset)
 - 18/0 circle hooks (10° offset)
 - Mackerel bait

2003 Experiments

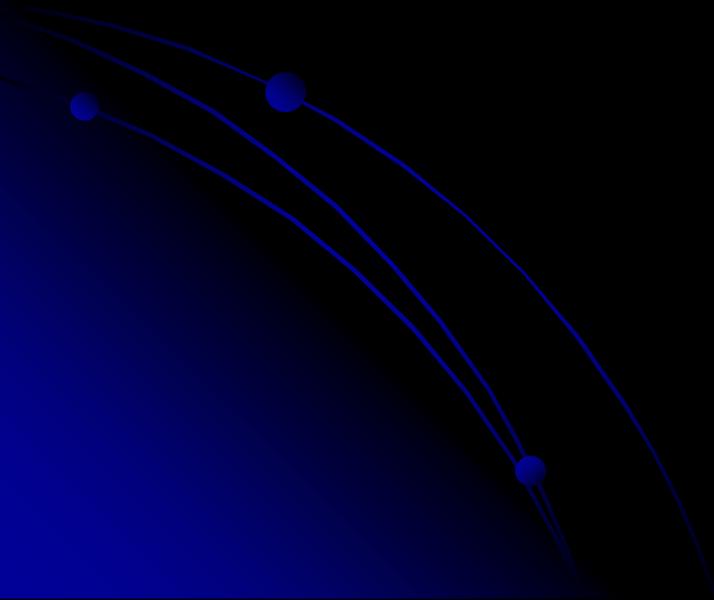
Swordfish Sets

- Controls were natural squid on 25°-30° offset 9/0 J-hooks.
- Treatments
 - Non offset 18/0 circle hooks with squid
 - 10° offset 18/0 circle hooks with mackerel
 - 10° offset 20/0 circle hooks with mackerel
 - 10/0 non offset tuna hook with mackerel bait.
- Collect data on hooking times for turtles, bycatch and directed catch using hook timers & time depth recorders.

2003 Experiments

Tuna Sets

- Control
 - 10° offset 16/0 circle hook with squid
- Treatment
 - 18/0 non offset 18/0 circle hook with squid



Hook Designs



9/0 J Hook



10/0 J Tuna Hook



16/0 Circle Hook



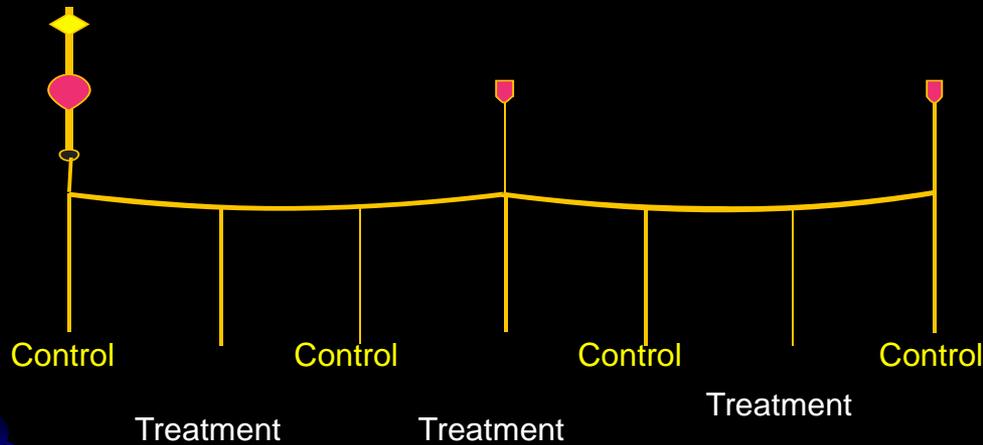
18/0 Circle Hook



20/0 Circle Hook

Experimental Design

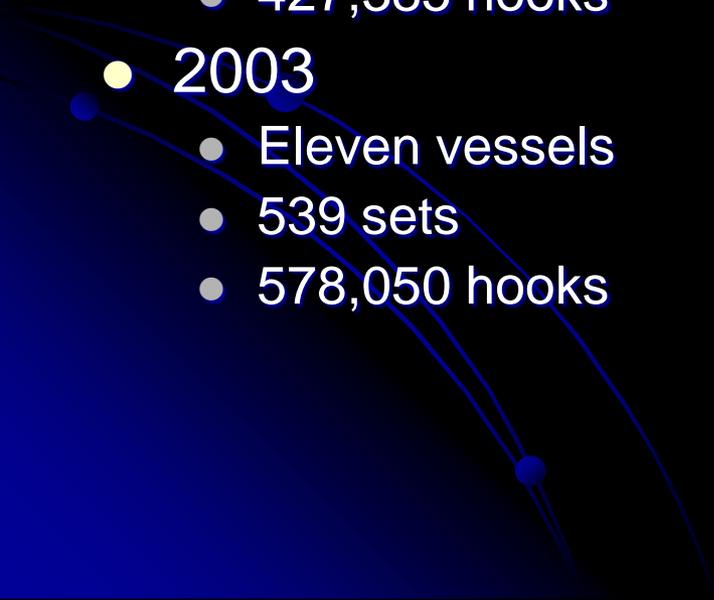
Set Configuration



Control: 9/0 J Hook
25-30 Deg. Offset
w/ Squid Bait

Treatments:
Experimental Hooks
Experimental Baits

Fishing Effort

- 2001
 - Eight vessels
 - 186 sets
 - 164,429 hooks
 - 2002
 - Thirteen vessels
 - 489 sets
 - 427,385 hooks
 - 2003
 - Eleven vessels
 - 539 sets
 - 578,050 hooks
- 

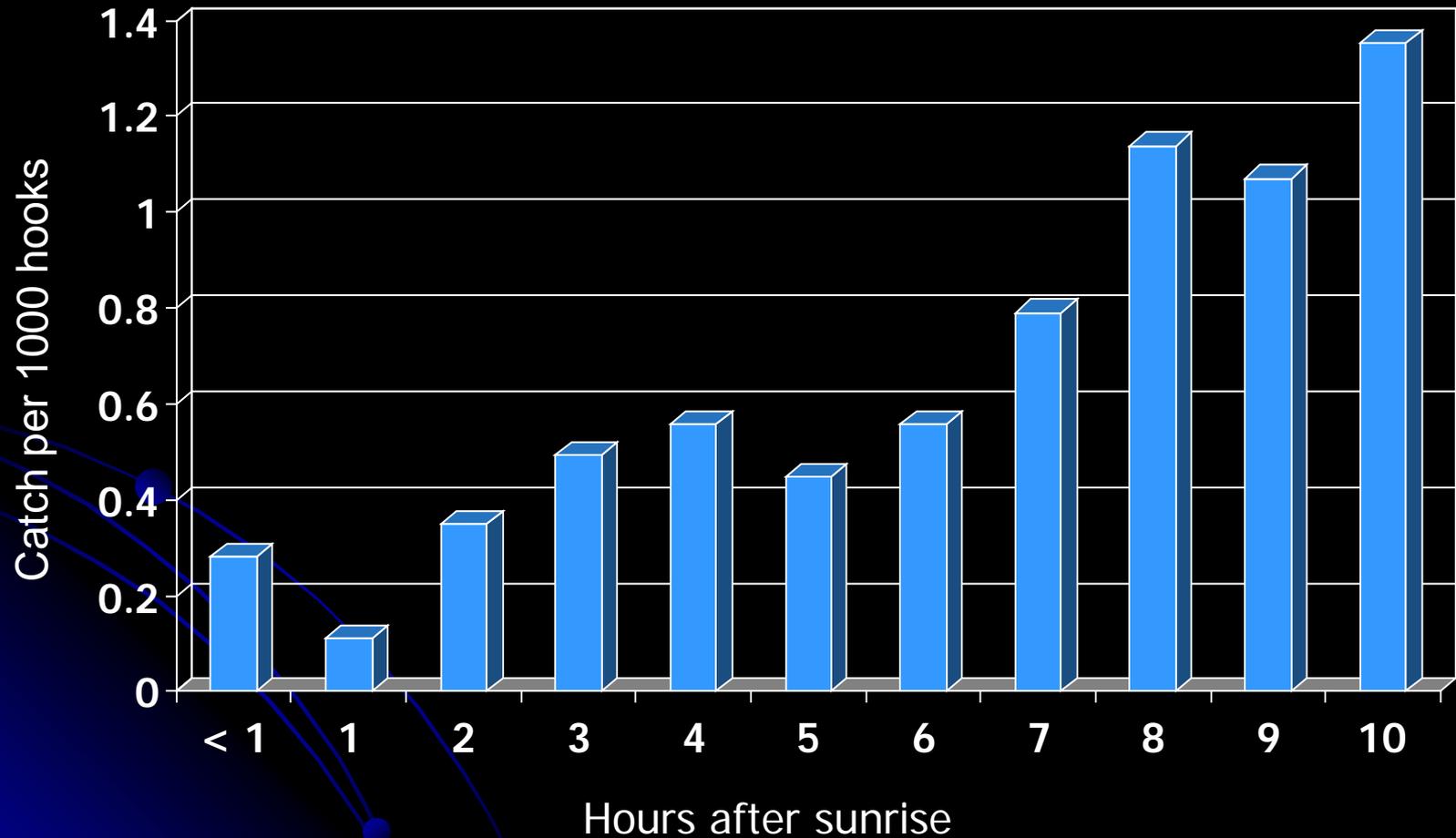
Turtle Interactions

- 2001
 - 142 loggerheads
 - 77 leatherbacks
 - 2002
 - 100 loggerheads
 - 158 leatherbacks
 - 2003
 - 92 loggerheads
 - 79 Leatherbacks
 - 1 Olive ridley
- 

2001 Results

- Blue-dyed Squid bait – **no significant effect**
 - Move branch line 20 fathoms away from buoy - **no significant effect for loggerheads**
increased catch of leatherbacks
 - Daylight soak time – **significant effect for**
Caretta
- 

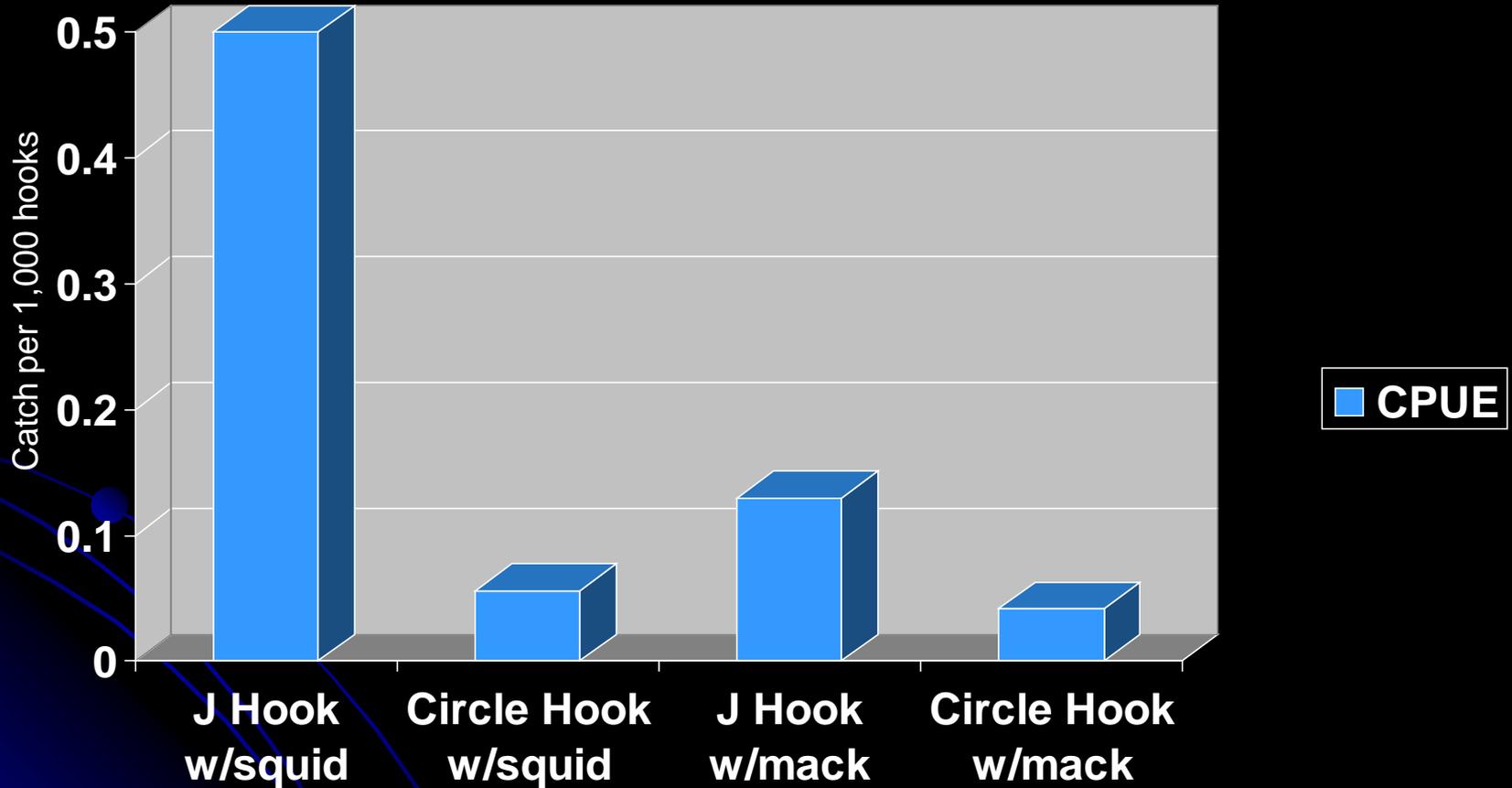
Loggerhead Catch by Daylight Soak-time



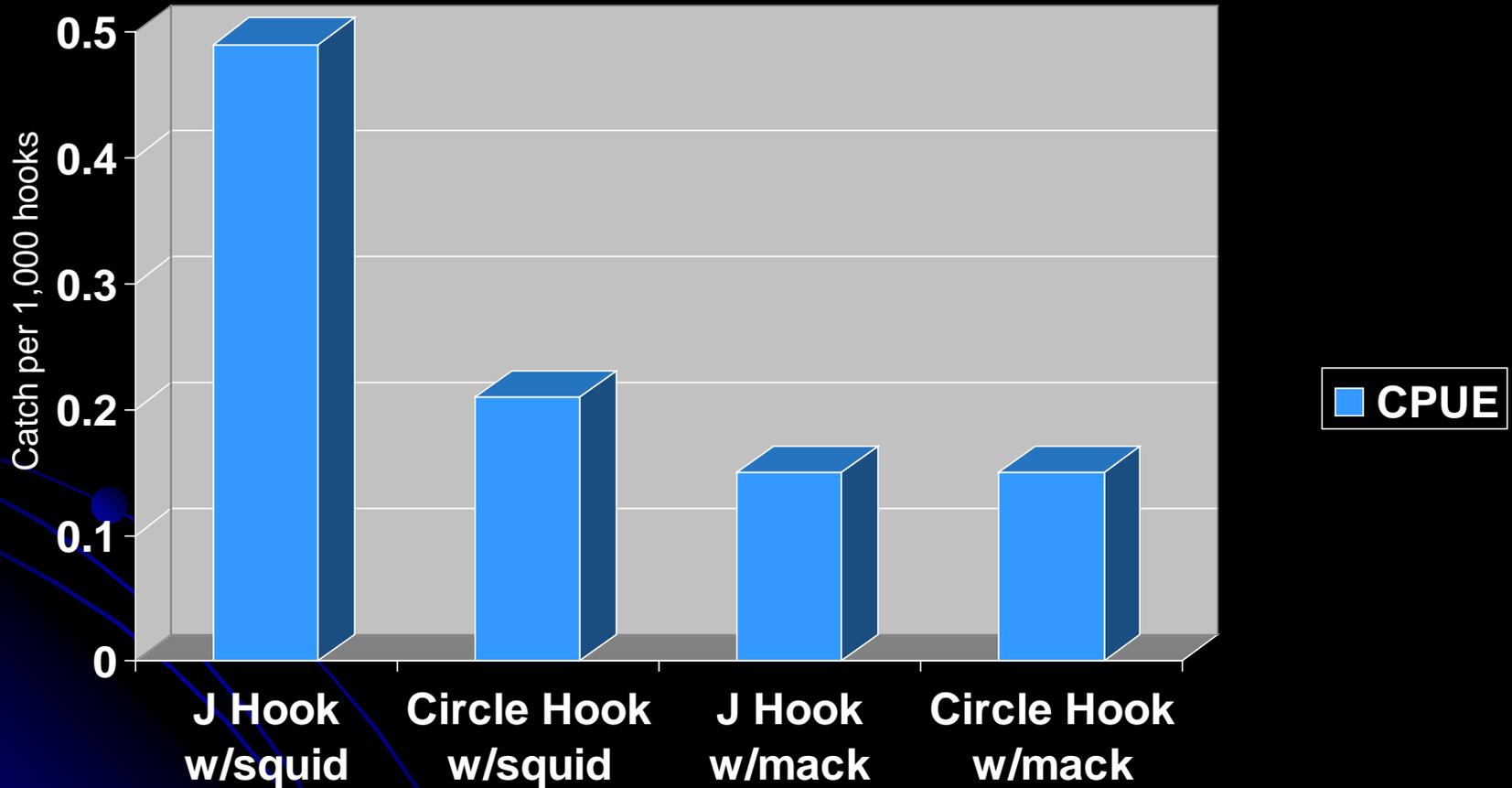
2002 Results

- Reduce daylight hook soak time – **Not significant**
- 18/0 circle hooks – **Significant reduction loggerheads and leatherbacks**
 - Squid bait – decrease in swordfish, increase in tuna
 - Mackerel bait - increase in swordfish, decrease in tuna
- Mackerel bait – **Significant reduction loggerheads and leatherbacks, increase in swordfish, decrease in tuna**

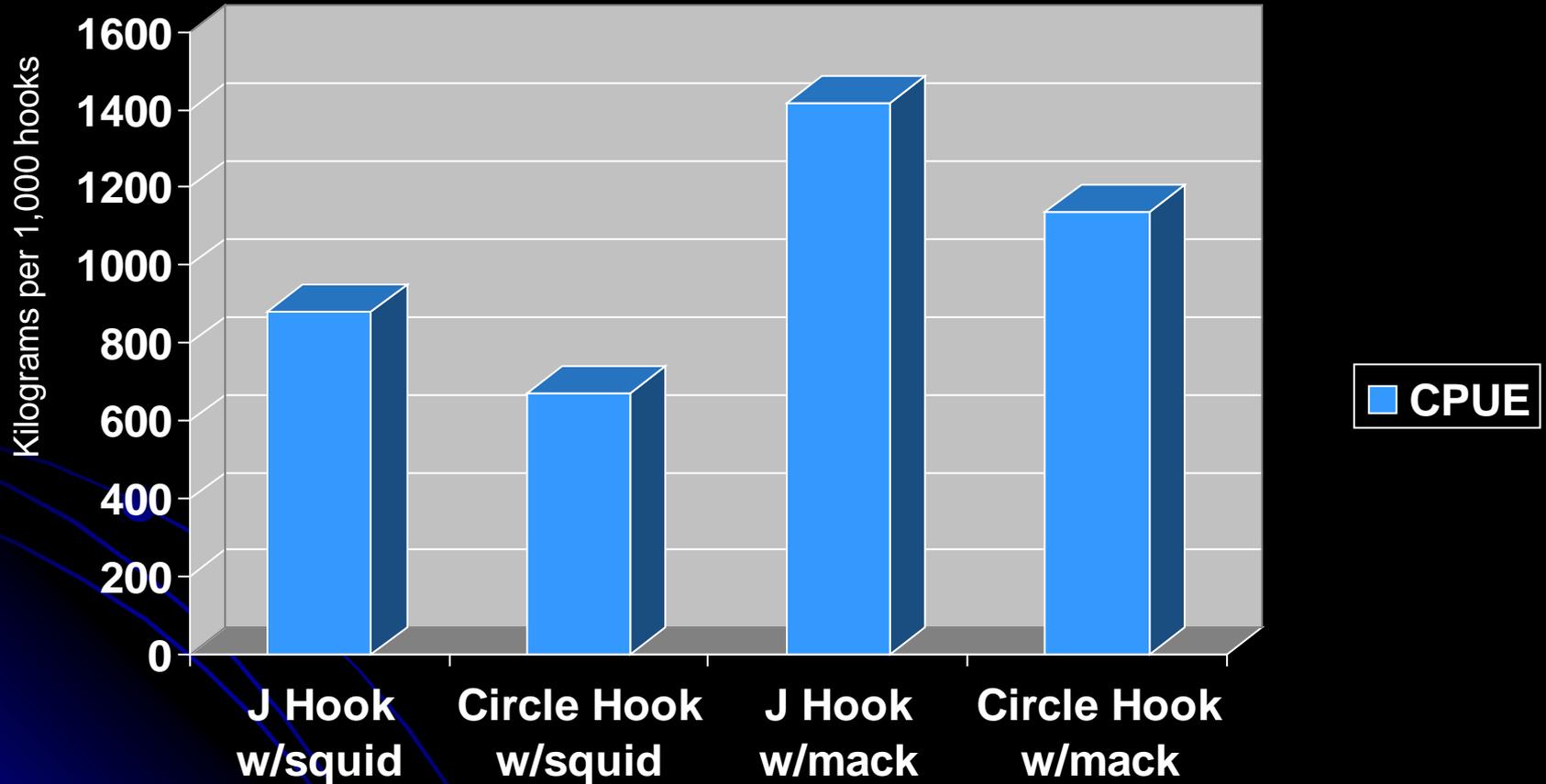
Loggerhead Turtle CPUE



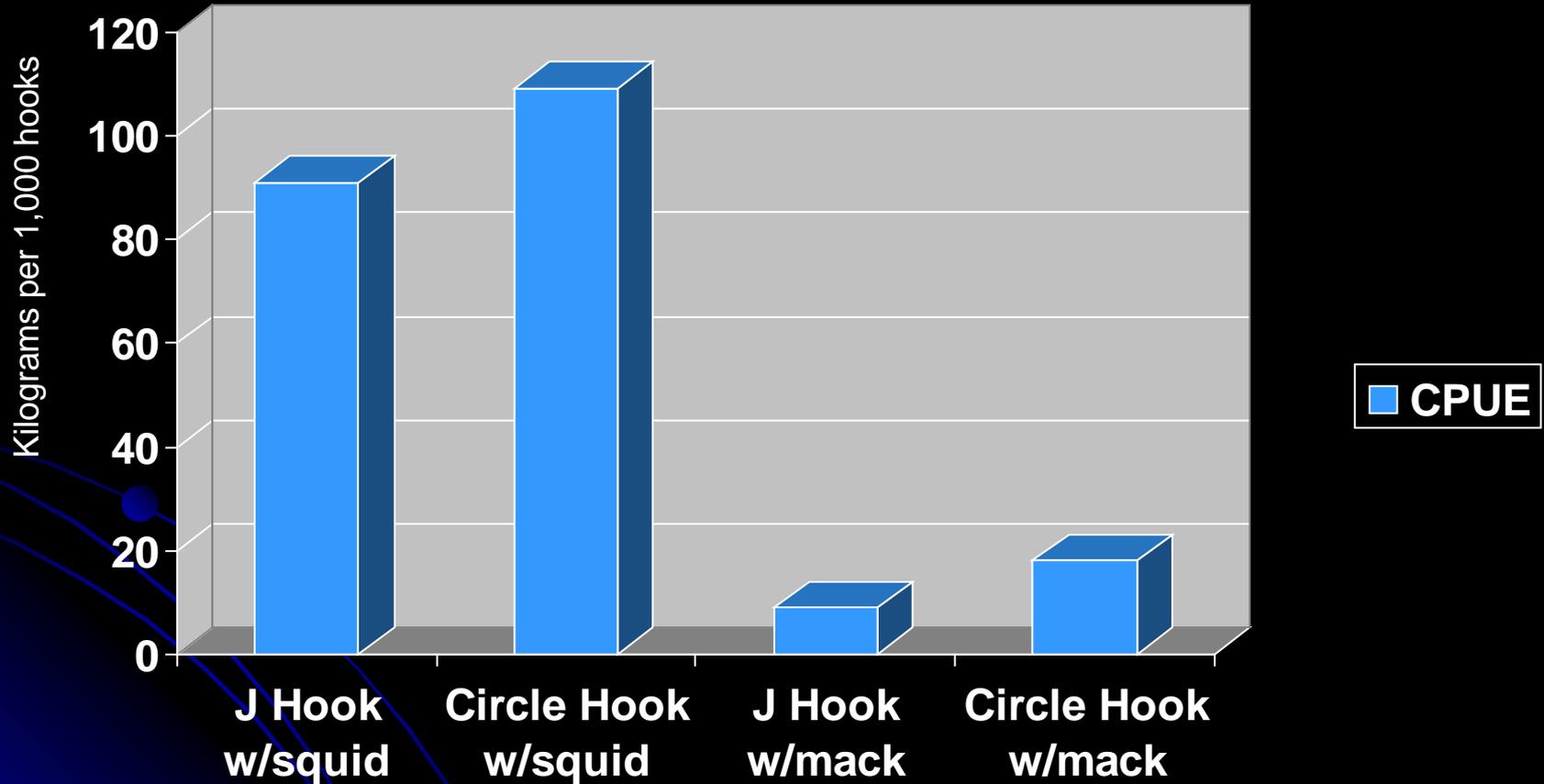
Leatherback Turtle CPUE



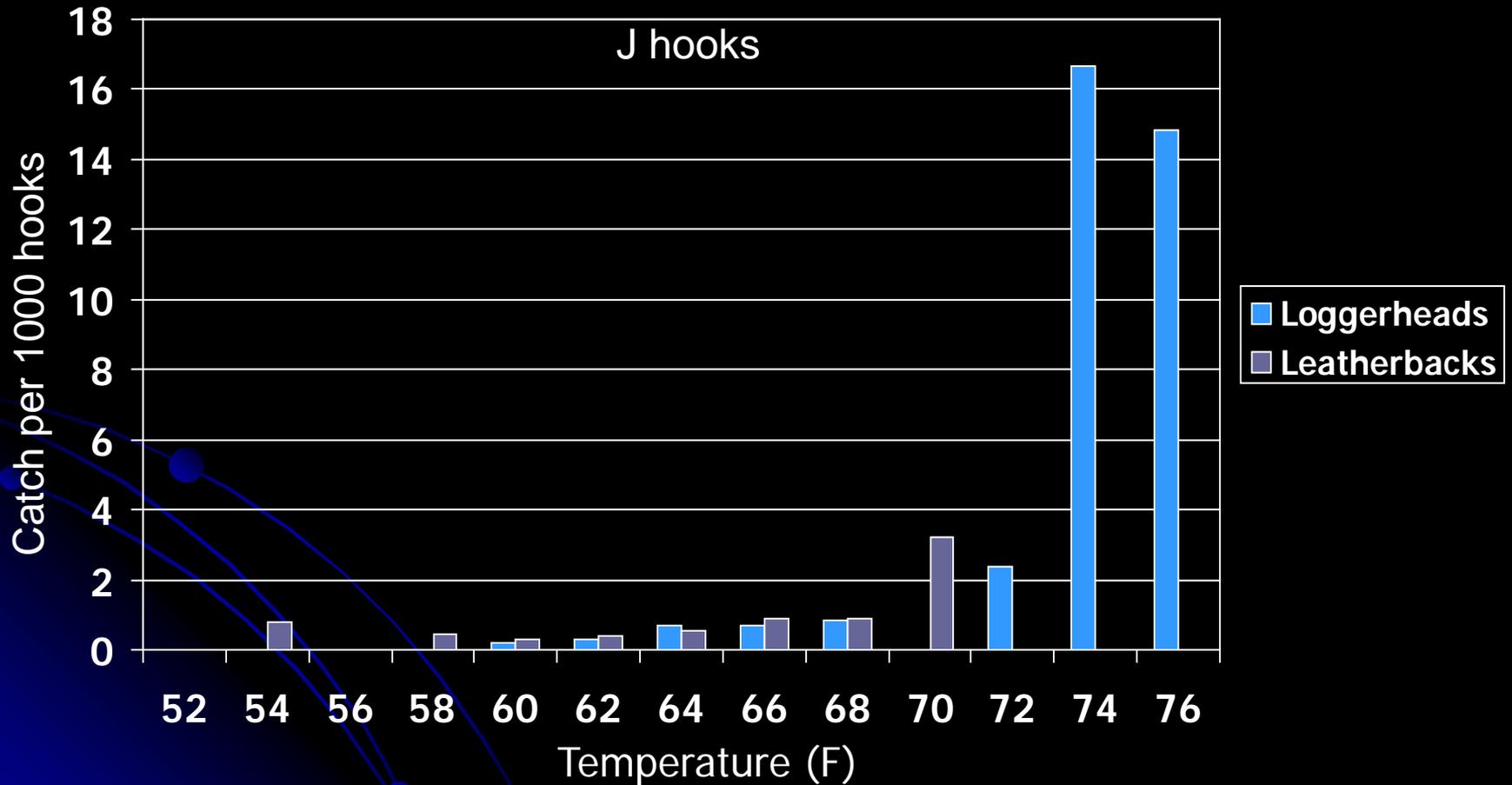
Swordfish CPUE



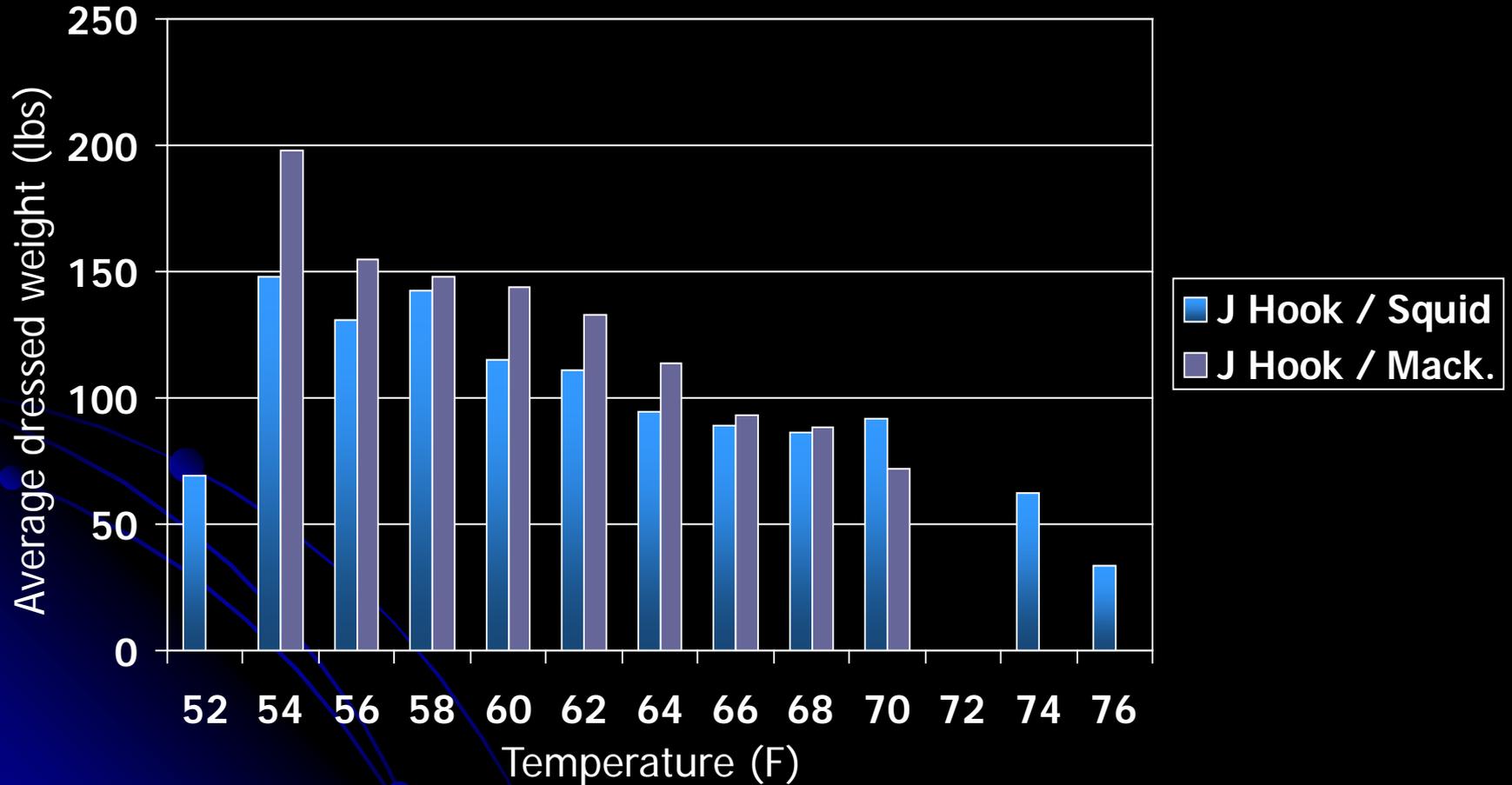
Bigeye Tuna CPUE



Turtle Catch by Temperature



Average Swordfish Weight by Temperature



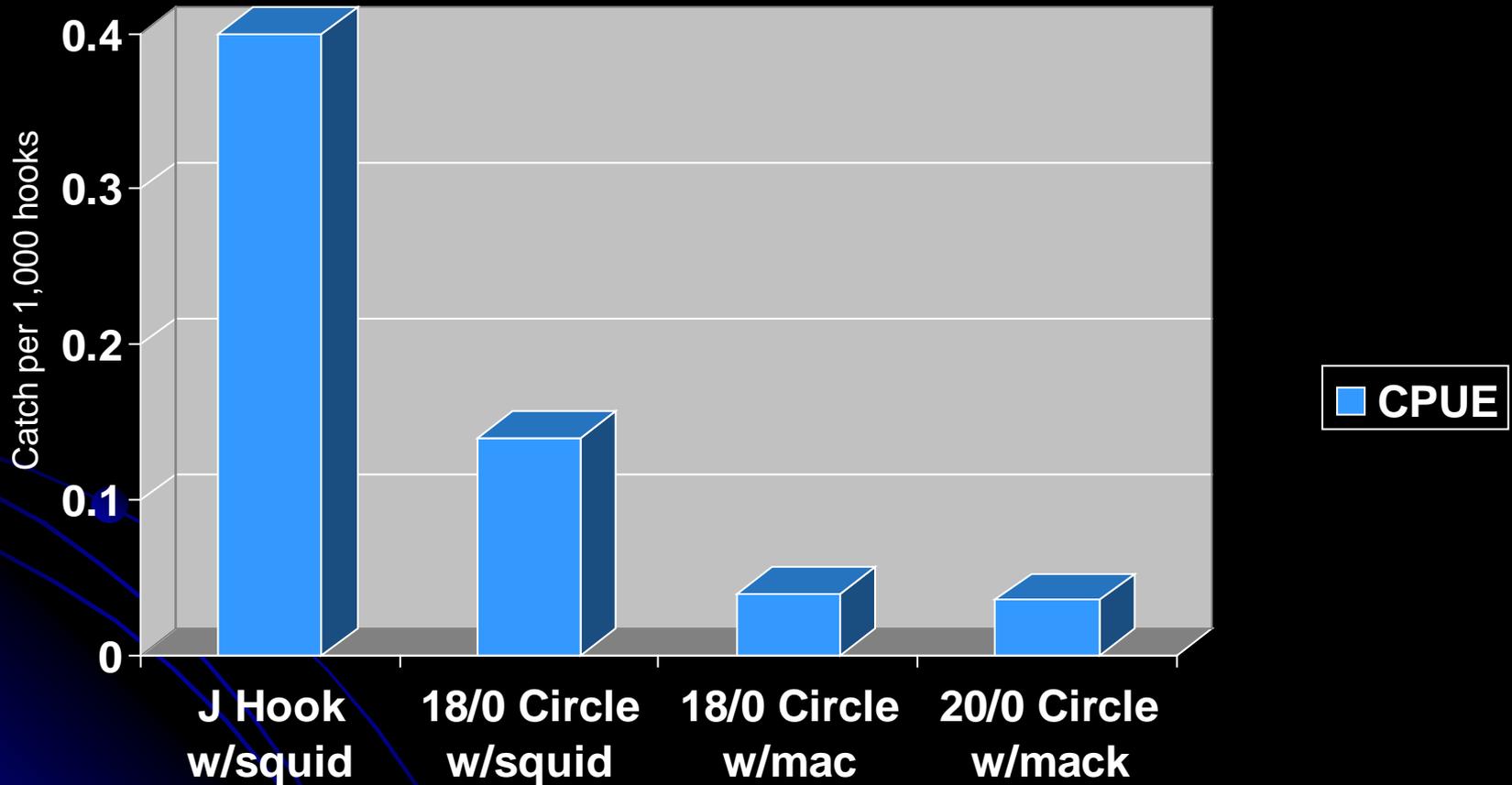
Cold Water.....Big Fish! Fewer Turtles!



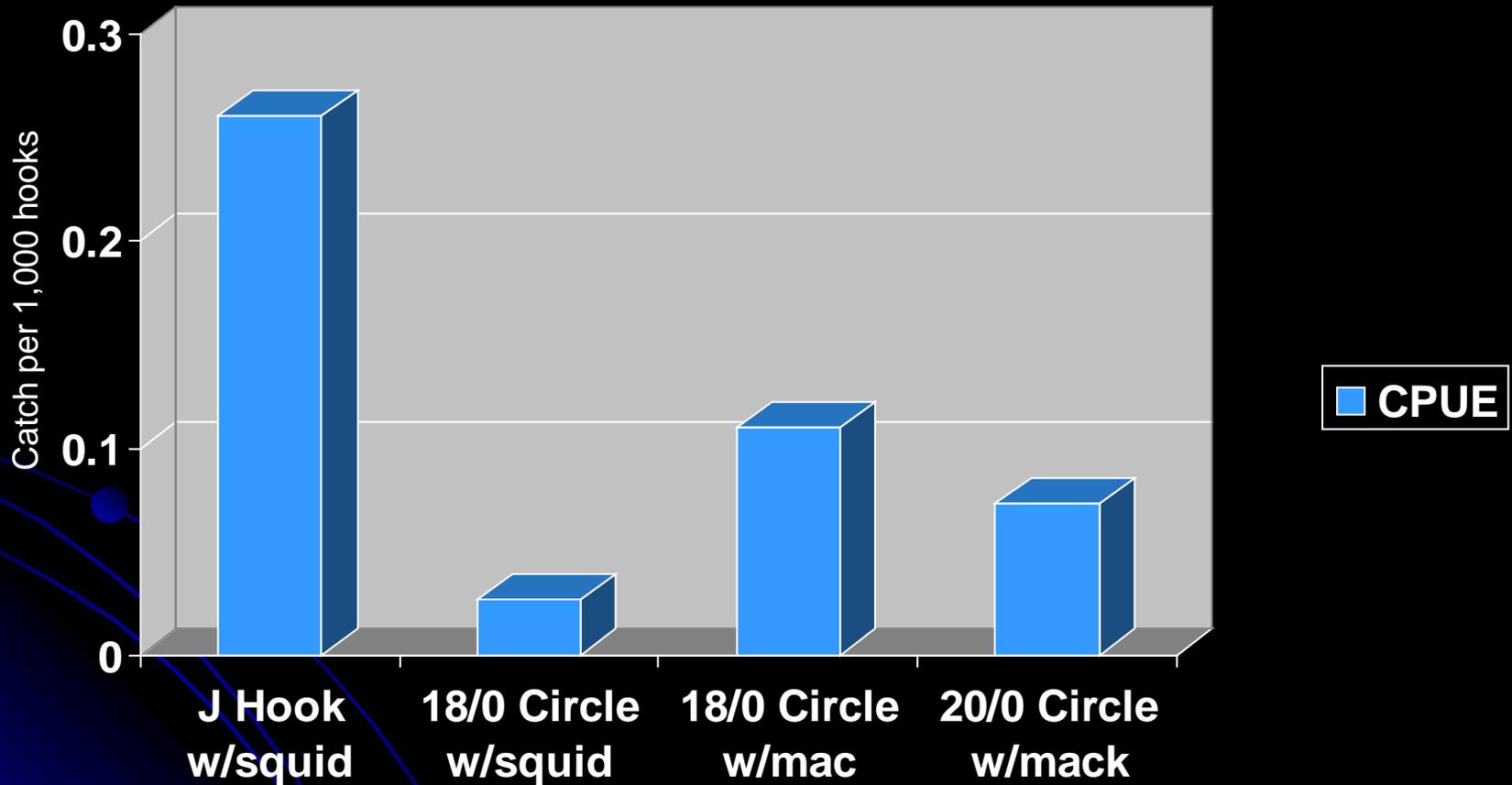
2003 Results

- 18/0 (non offset) circle hooks with squid bait
Significant reduction loggerheads and leatherbacks, decreased swordfish catch, increased tuna catch
- 18/0 (10° offset) circle hooks with mackerel bait
Significant reduction loggerheads and leatherbacks, increased swordfish catch, decreased tuna catch
- 20/0 (10° offset) circle hooks with mackerel bait
Significant reduction loggerheads and leatherbacks, increased swordfish catch, decreased tuna catch

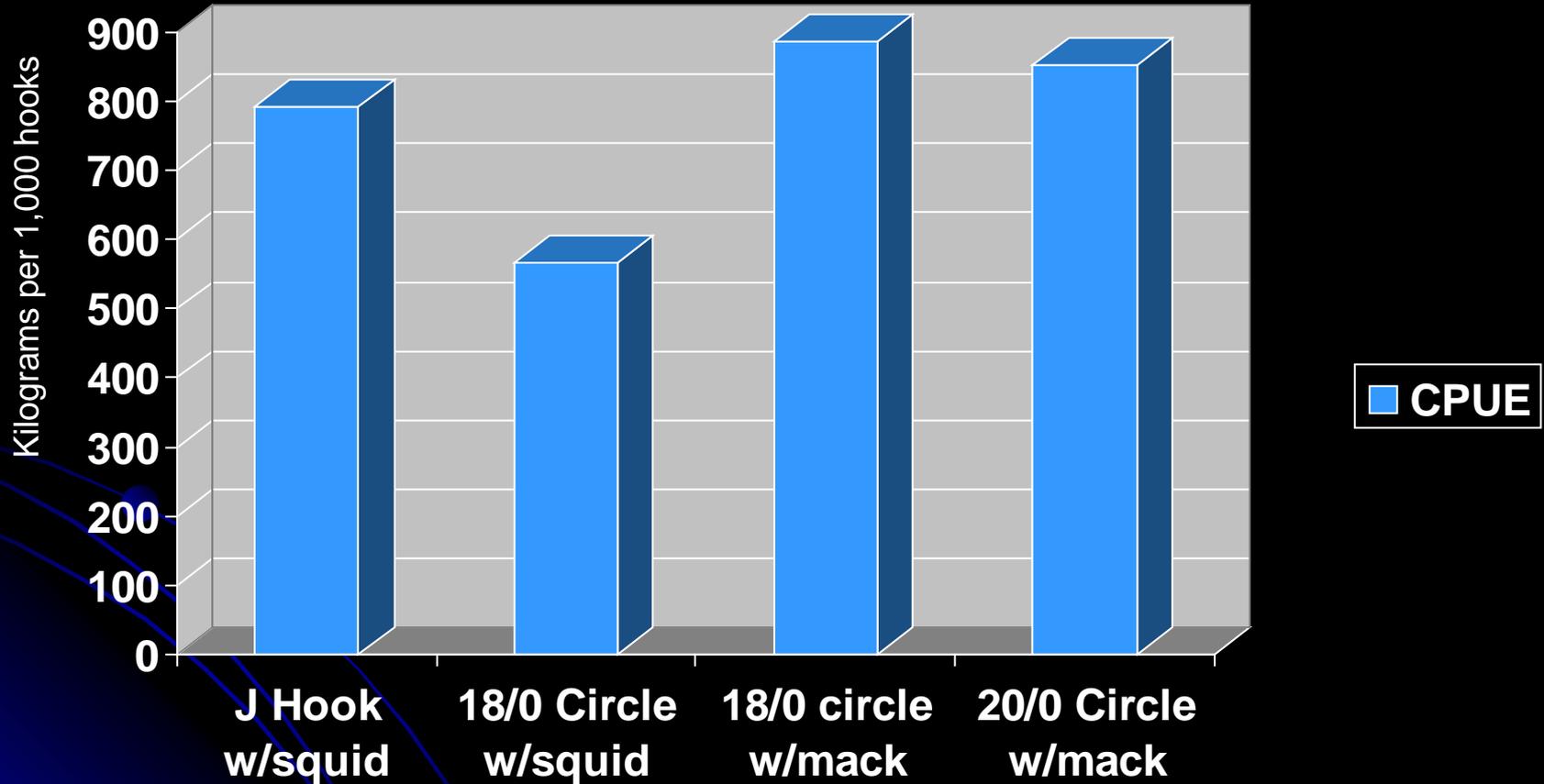
Loggerhead Turtle CPUE



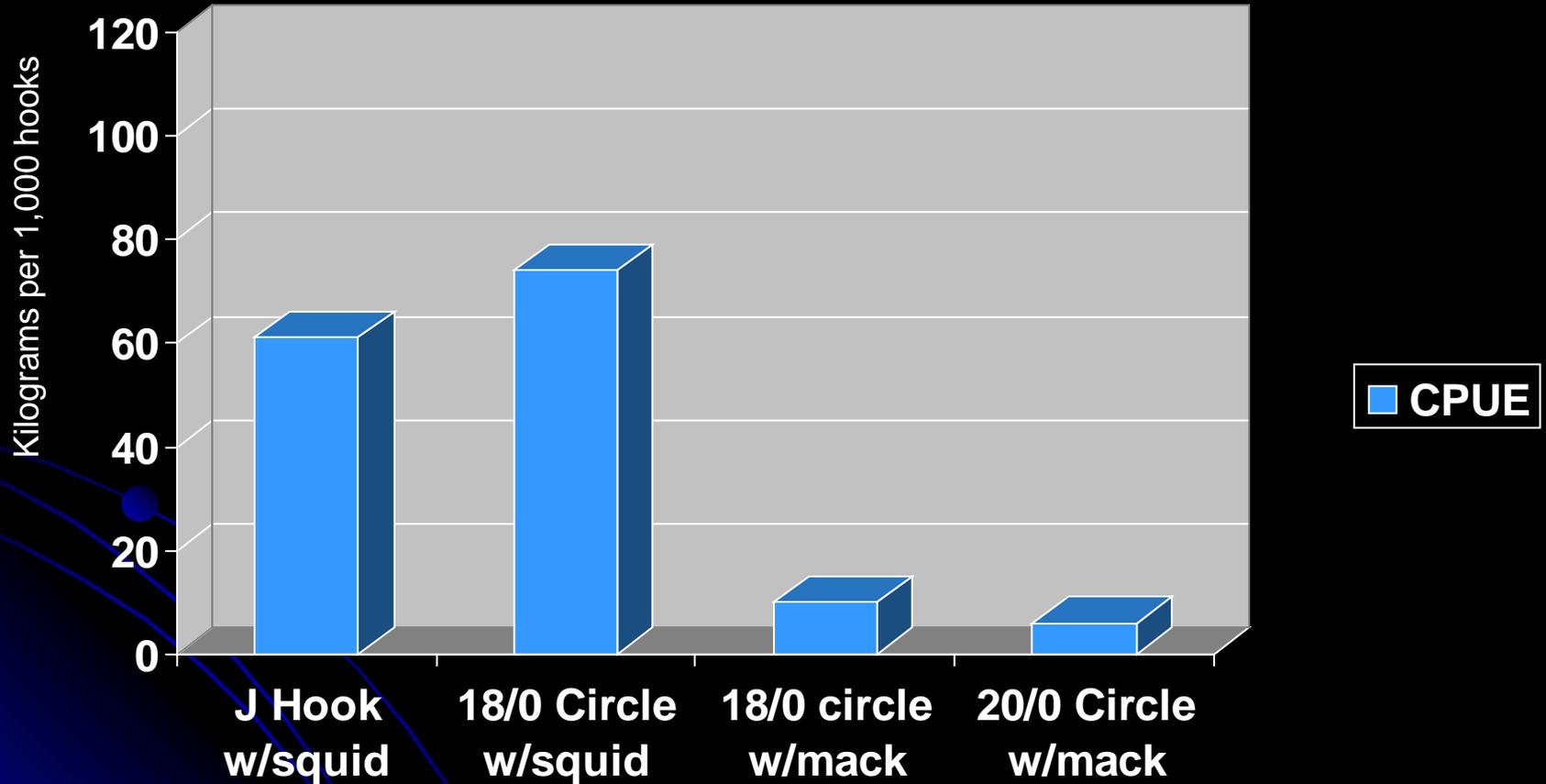
Leatherback Turtle CPUE



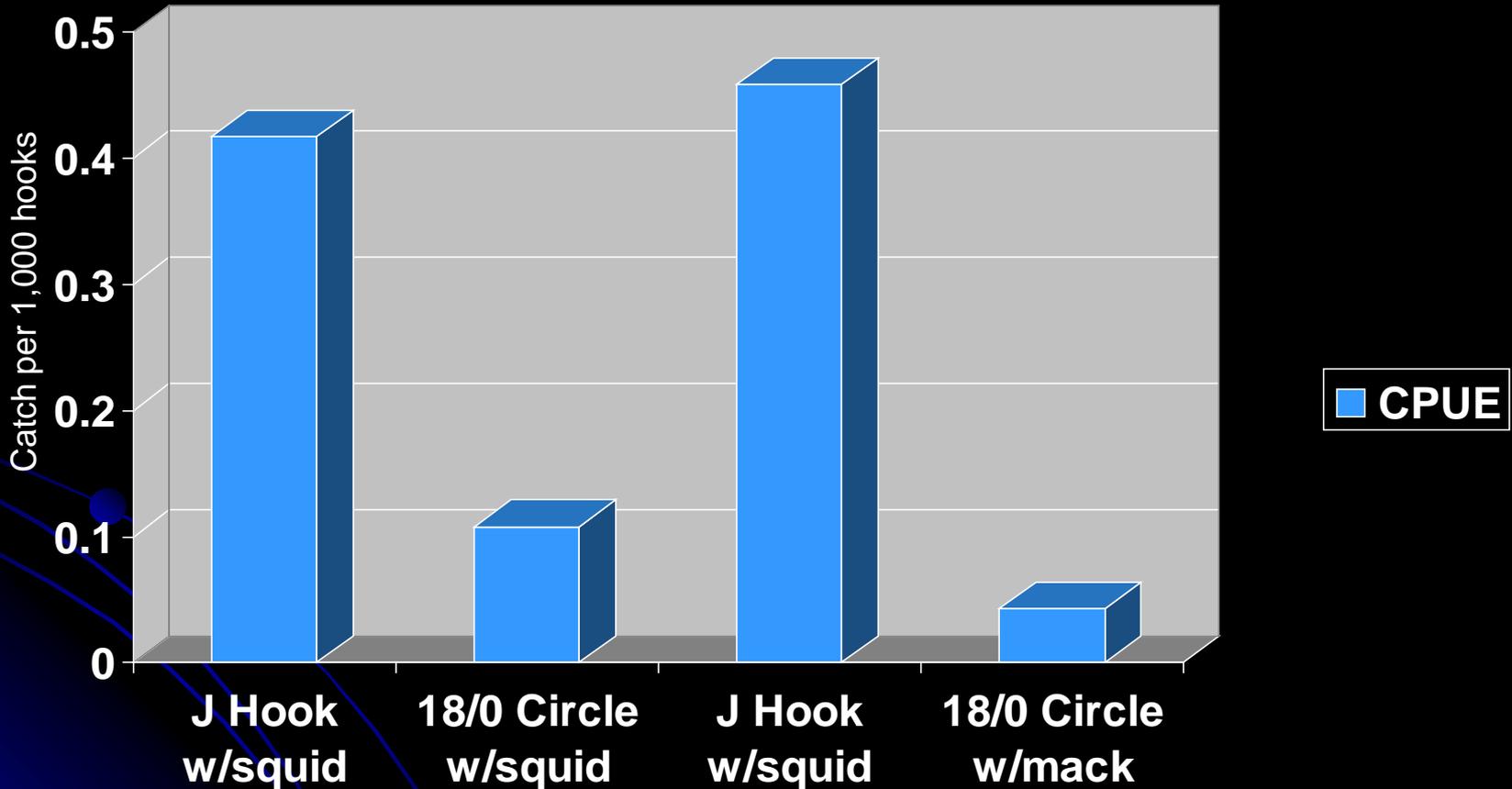
Swordfish CPUE



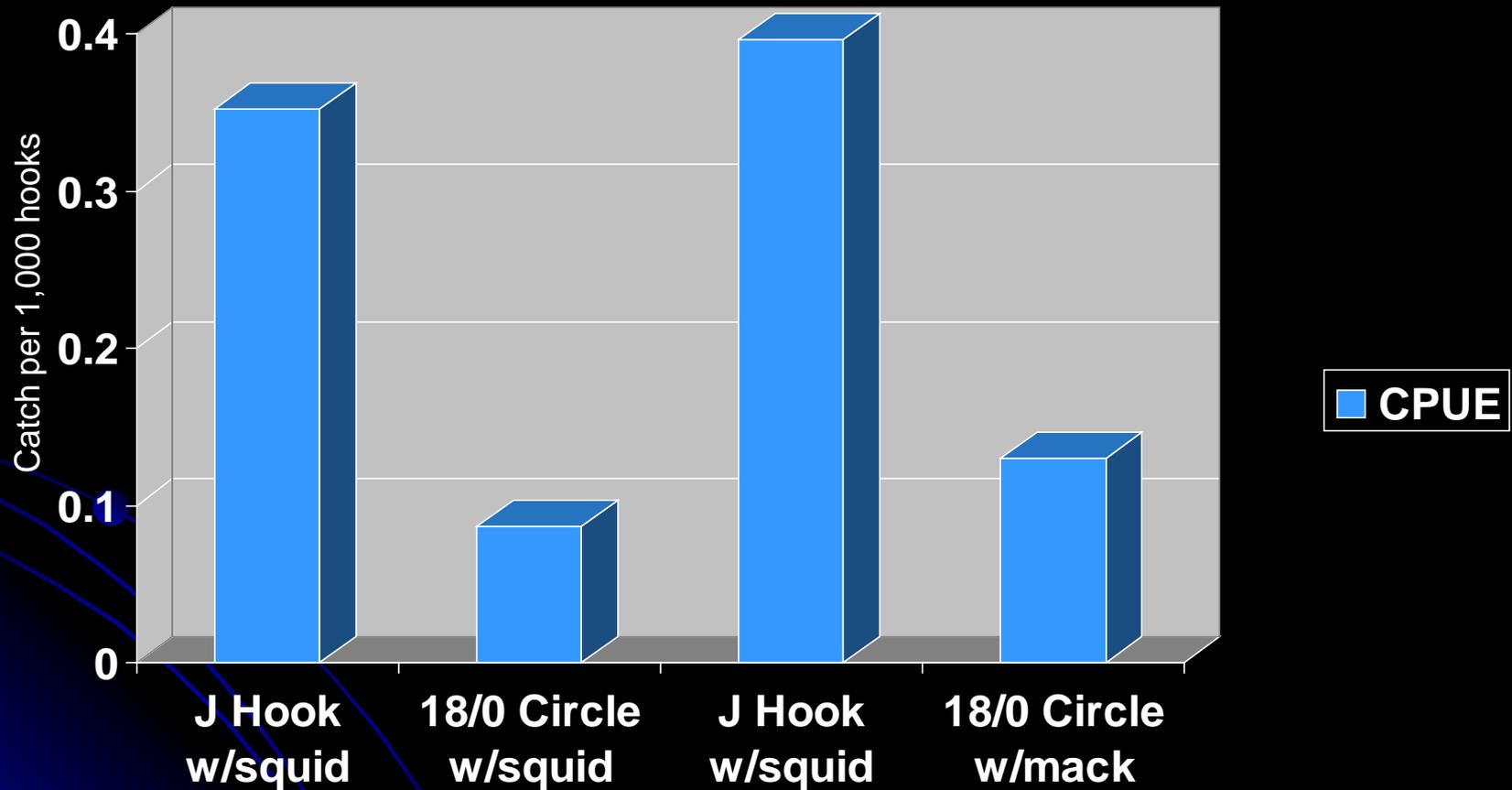
Bigeye Tuna CPUE



Loggerhead Turtle CPUE Pooled Data 2002 & 2003



Leatherback Turtle CPUE Pooled Data 2002 & 2003



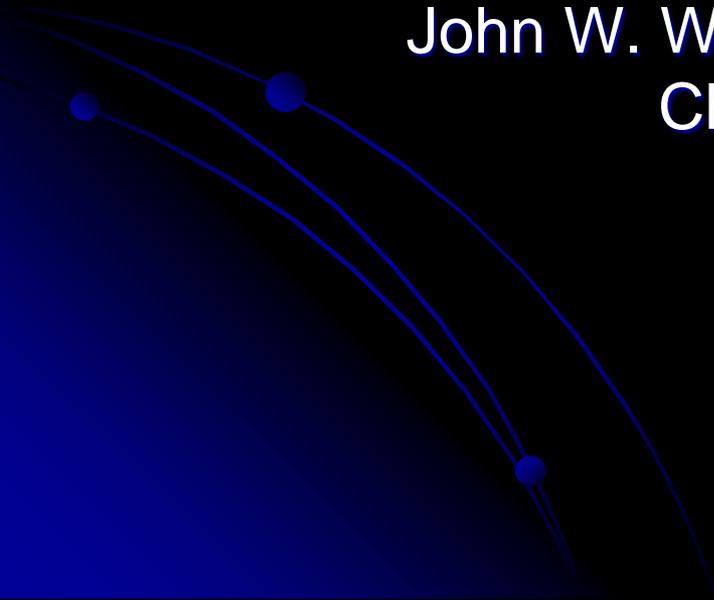
Tuna Directed Research Results

- Sample size is too small to determine effect, but preliminary numbers indicate reductions in both loggerhead and leatherback turtles with 18/0 circle hooks compared to 16/0 circle hooks. Bigeye tuna catches were similar and there was a slight increase in yellowfin tuna catch with 18/0 circle hooks versus 16/0 circle hooks

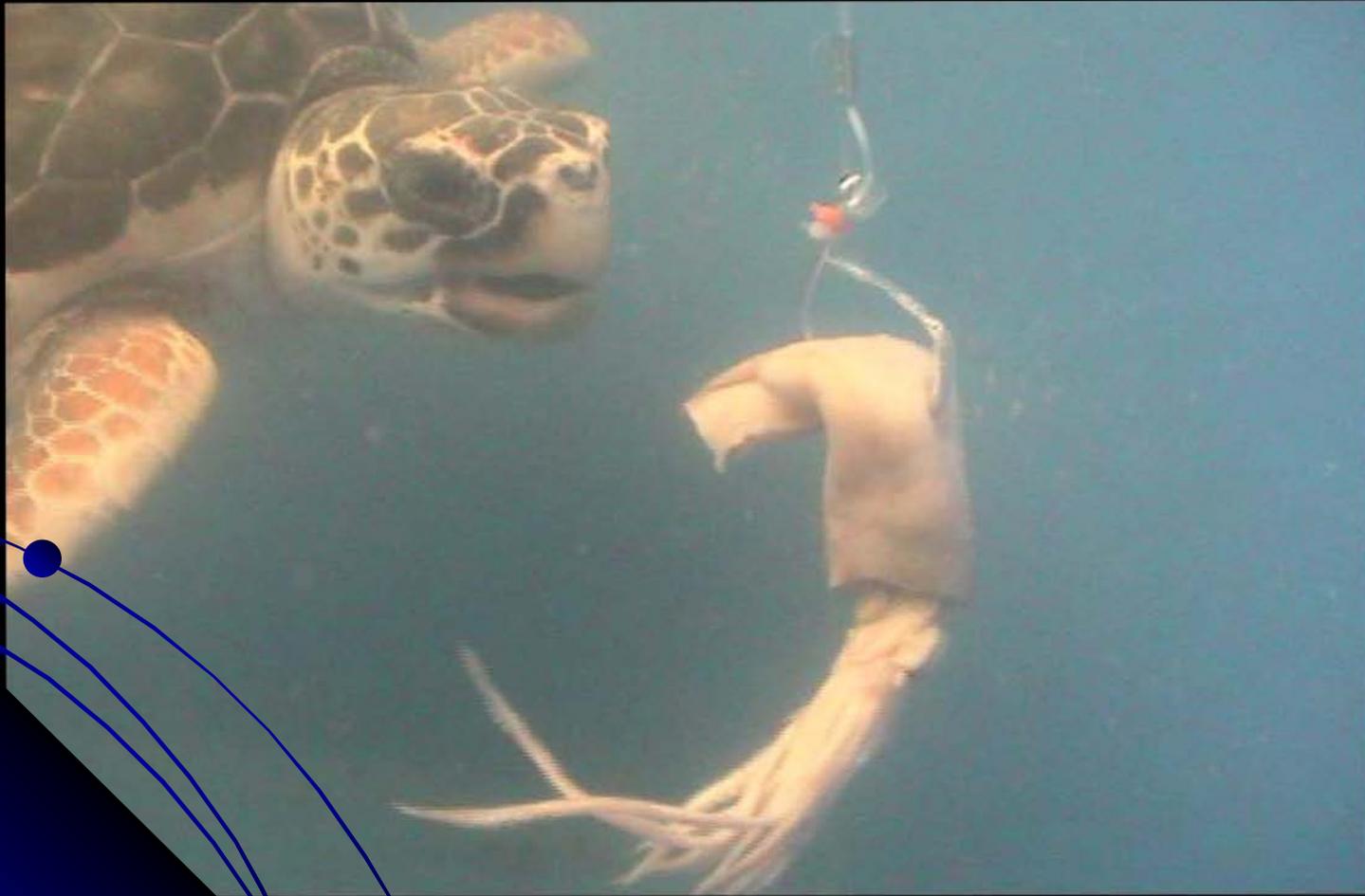
Effect of Hook Size on Ingestion of Hooks by Loggerhead Sea Turtles

John W. Watson, Bret D. Hataway, and
Charles E. Bergmann

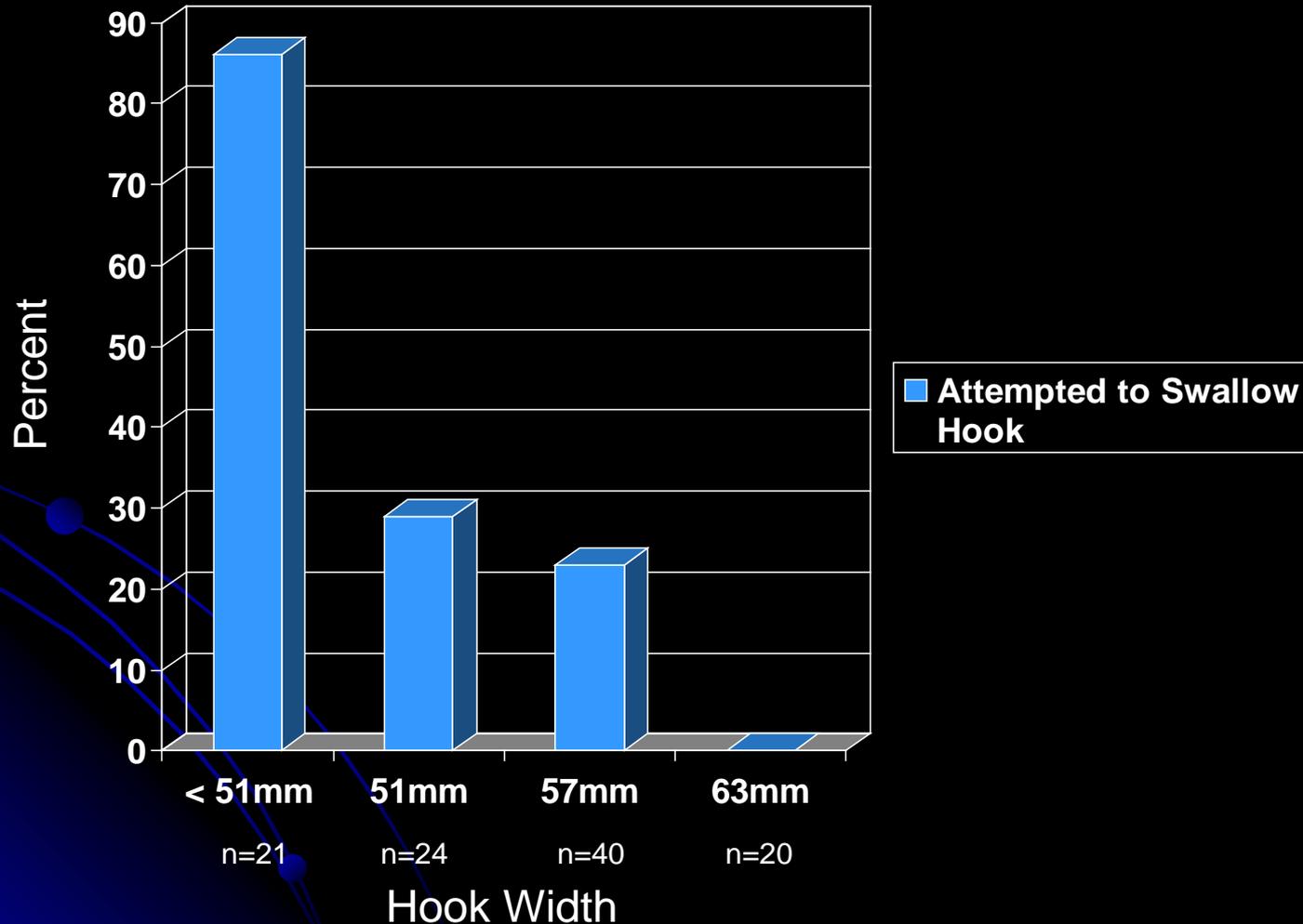
June, 2003



Squid Bait Rigging



Effect of Hook Width on Ingestion of Hooks by Loggerhead Turtles (40-60 cm Length)



Summary of Logistic Regression Analysis on Hook Swallowing Attempts

Explanatory Variable	Coefficient (SE)	Odds Ratio (90% CI)	<i>p</i> value
Turtle Size CCL (mm)	0.015 (0.006)	1.015 (1.004-1.026)	0.0196
Hook Width (mm)	-0.157 (0.045)	0.855 (0.794-0.921)	0.0005
Hook Length (mm)	-0.043 (0.024)	0.958 (0.920-0.997)	0.0772

Squid Bait only, n=105

Stepwise technique used with a sig level of 0.1 for model entry and retention

Hosmer and Lemeshow Goodness-of-Fit Test: Chi-Sqr=8.38, df=7, *p* = 0.2998

Hook Dimensions

Hook Type	Hook Width	Hook Length
9/0 J	41 mm	78 mm
9/0 Tuna	33 mm	78 mm
10/0 Tuna	38 mm	86 mm
11/0 J	51 mm	98 mm
16/0 Circle	51 mm	73 mm
11/0 MJ	56 mm	86 mm
18/0 Circle	57 mm	86 mm
12/0 J	57 mm	111 mm
14/0 J	63 mm	130 mm
20/0 Circle	63 mm	100 mm

ACKNOWLEDGMENTS

- Pelagic longline Captains, Crews, and Owners
- Blue Water Fishermen's Assoc.
- NOAA /Johnson Control Fisheries Observers
- ARC
- Lingren Pitman
- Charlie Bergmann, Myrto Argyropoulou, Dennis Lee, Cheryl Brown, Larry Beerkircher, Lesley Stokes, Lisa Belskis, Dominy Hataway, Nick Hopkins, Lionel LaForce, Ron Rinaldo, Sari Karaly, Steve Myers, Ad Hoc advisory group
- Bill Hogarth