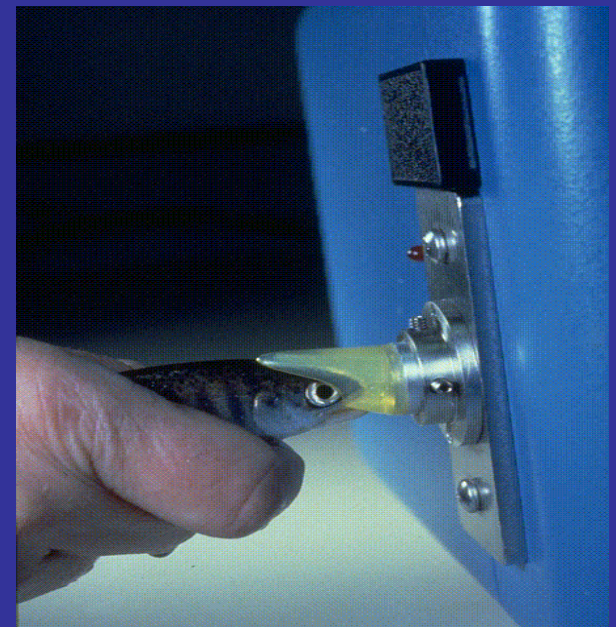


Overview of FWS lake trout coded-wire tag program In lakes Michigan and Huron: the past, present, and future

Chuck Bronte and Aaron Woldt
U.S. Fish and Wildlife Service



Outline of the talk:

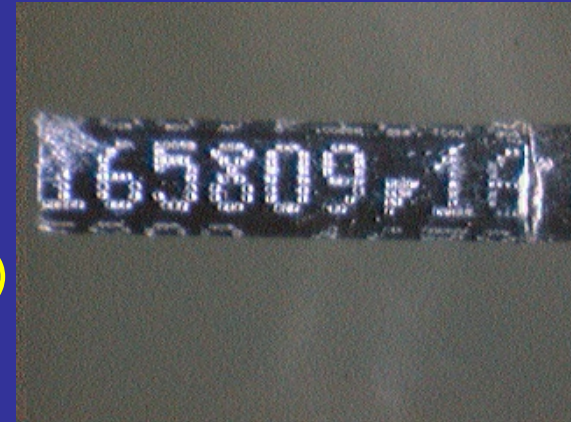
History of CWTs use in Lake Michigan (Bronte)

- original objectives
- what was actually done
- results of published and unpublished uses of the data
- new studies

History of CWTs use in Lake Michigan (Woldt)

- original objectives
- what was actually done
- results of published and unpublished uses of the data
- new studies

CLC Mass marking Initiative – a paradigm shift for the future.
(Bronte)



Initial CWT studies in Lake Michigan

Associated with the evaluation of relative survival among strains at the newly created refuges from the 1985 Rehabilitation plan.

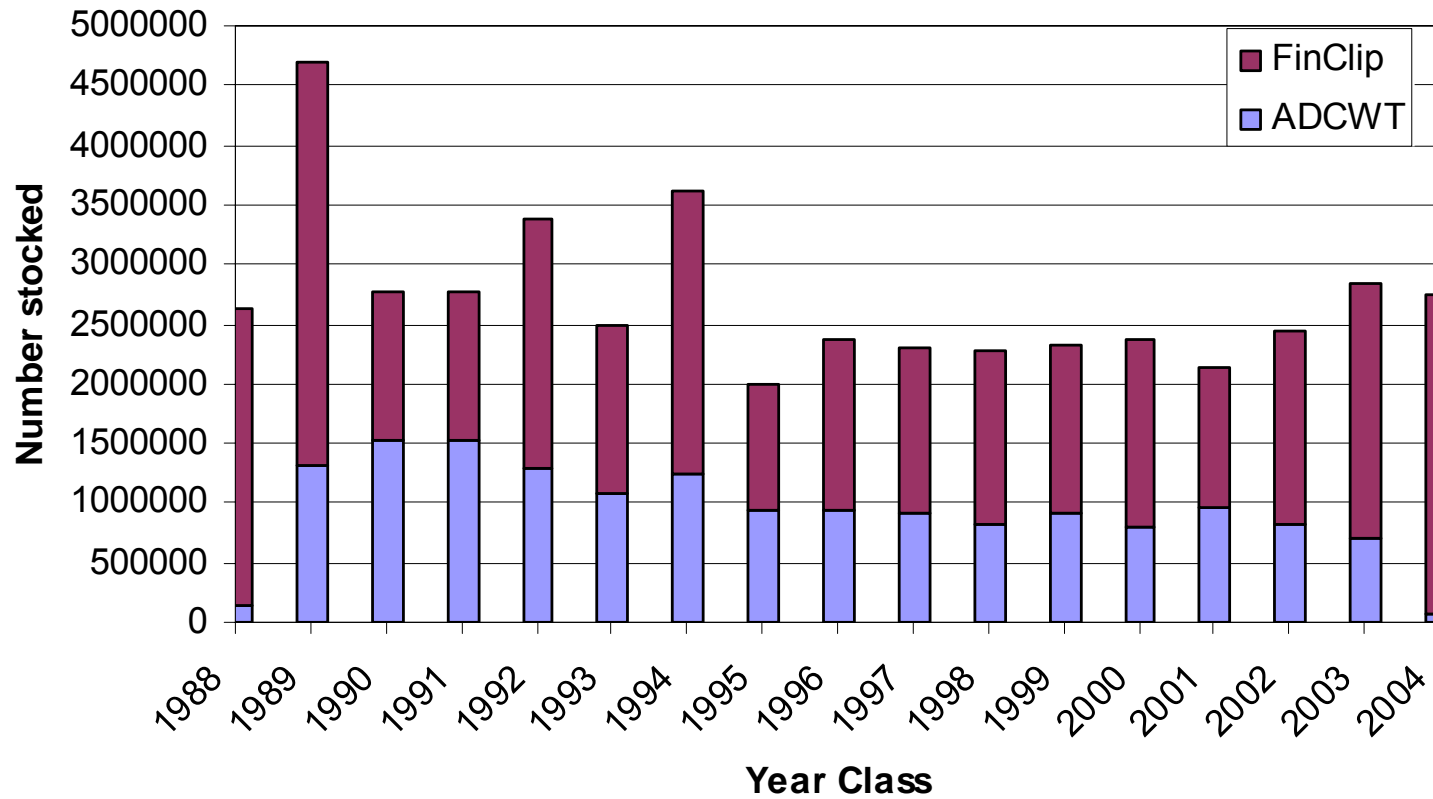
Northern Refuge (Fox Islands/ Beaver Island)

For at least 5 consecutive springs beginning in 1986, experimentally plant yearling lake trout on Boulder, Gull, Richards and South Fix Island—mark all fish with CWTs with lots identifying strains → Marquette (L. Superior), Lewis Lake (L. Michigan remnant), Gull island Shoal (L. Superior).

Southern Refuge (MidLake Reef Complex)

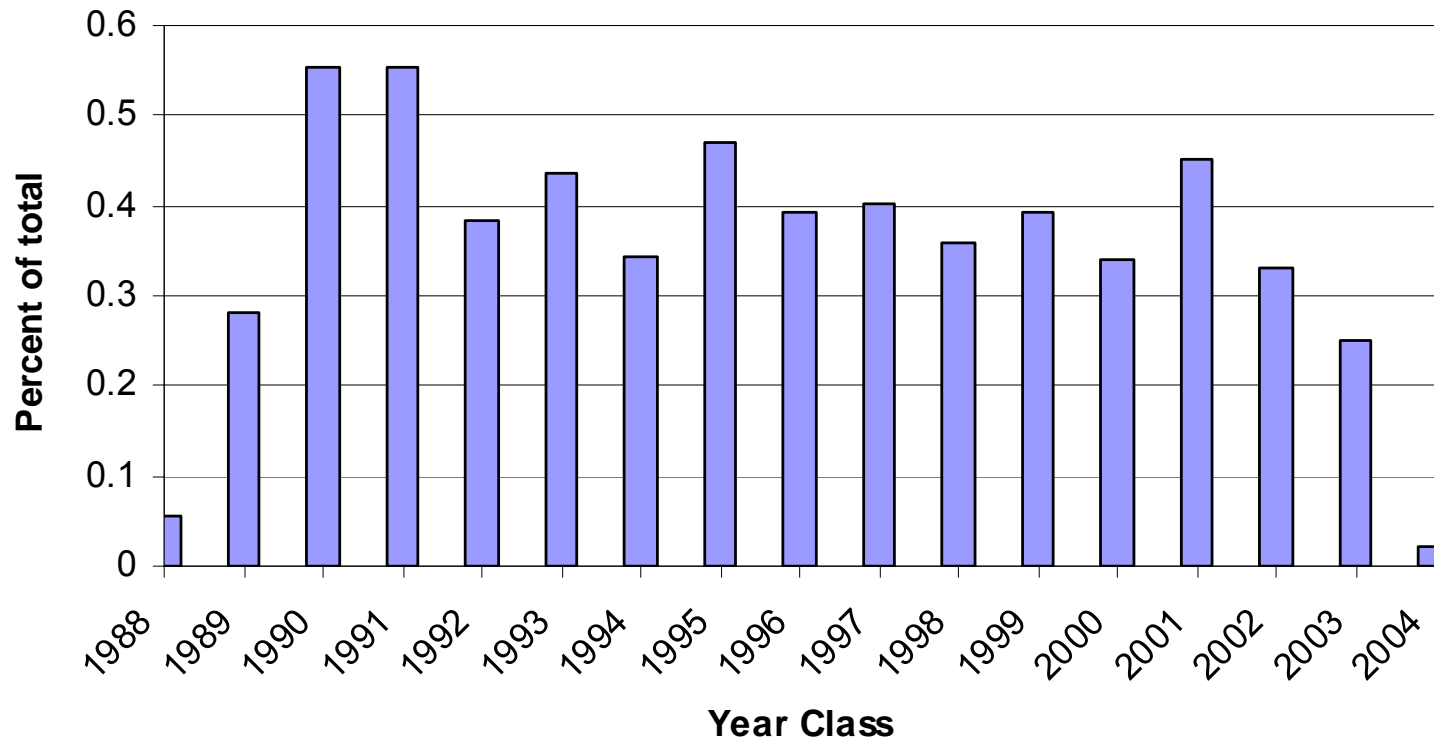
Seneca (Finger Lakes), Green Lake (L. Michigan remnant) strains and Marquette as control.

CWT history in Lake Michigan Yearlings and fall fingerlings



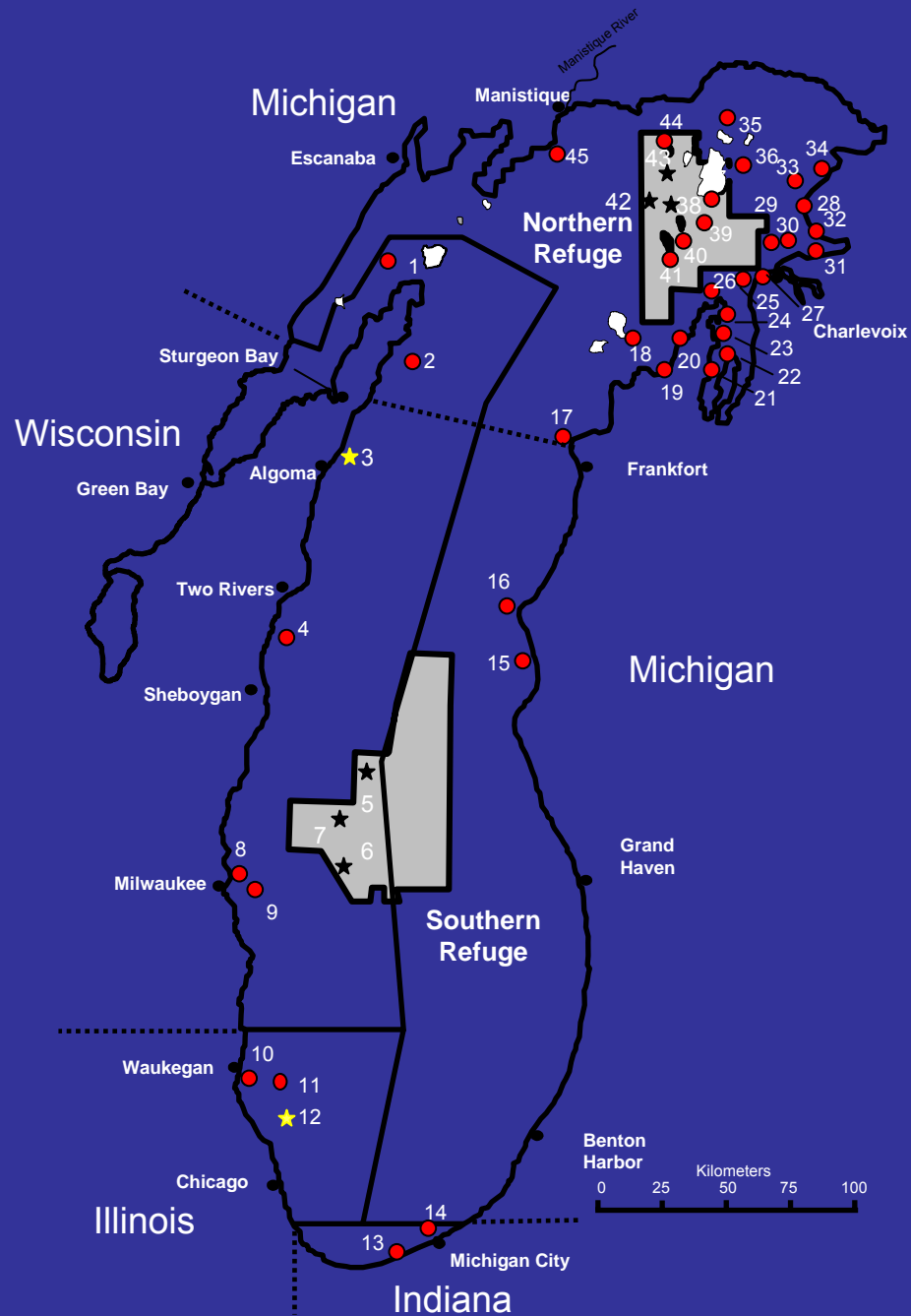
CWT history in Lake Michigan

Percent of fish stocked with CWT



Year Class	Other sites		Northern Refuge			Southern Refuge		
	Juliens Rf	Clay Bks	Boulder	Gull Is Sh	Richards Rf	East Rf	NE Rf	Sheboygan Rf
1984								774,968
1985			173,347	353,152	176,575			575,126
1988					149,000			
1989			175,975	204,527	237,084		345,897	353,632
1990		15,083	260,000	256,000	256,500	231,070	275,412	215,644
1991			252,500	258,000	255,500	258,272	250,029	257,092
1992			263,958	260,679	268,565	163,022	166,158	165,853
1993			257,539	255,813	255,617	107,414	102,364	107,165
1994	59,600	123,000	187,800	199,300	194,000	123,400	123,600	124,700
1995	60,900	121,500	150,800	151,900	152,300	100,500	101,000	100,500
1996	60,000	121,400	151,100	147,800	150,000	103,900	103,200	100,400
1997	60,000	114,900	149,400	150,900	151,100	100,000	98,500	100,000
1998	64,000		149,600	151,900	147,900	100,600	100,100	101,000
1999		116,066	150,750	149,666	46,232	87,500	101,000	101,000
2000	59,240		148,490	149,527	145,809	102,000	101,000	102,000
2001	61,024		154,310	150,028	147,747	101,150		101,060
2002	60,770		150,436	148,039		102,205	101,716	101,325
2003	60,300		116,653	117,190		100,840	105,035	100,975
2004	62,832							
Totals	608,666	611,949	2,892,658	3,104,421	2,733,929	1,781,873	2,075,011	3,482,440

Total since 1984 = 18.2 million



Stocking history of CWT fish by strain at Northern Refuge

Year Class	Green Lake	Lewis Lake	Seneca Lake	Marquette
1984				
1985	234388			527129
1988	149000			149000
1989	307254		106087	357947
1990	384000			516500
1991	415500			481500
1992	308300	251002		344700
1993	257400	251369		346600
1994	195600	200200		247300
1995	151400	152000	151600	51600
1996	148300	150300	150300	50000
1997	151400	150000	150000	51100
1998	149400	150000	150000	47900
1999	144648	101000	101000	46232
2000	143926	147300	152600	48009
2001	151466	149389	151230	48632
2002	145124	144525	154892	
2003	113846	113358	116727	
2004				
Total	3,550,952	1,960,443	1,384,436	3,314,149

Stocking history of CWT fish by strain at Southern Refuge

Year Class	Green Lake	Lewis Lake	Seneca Lake	Marquette
1984			380,006	394,962
1985			238,780	336,346
1988				0
1989		423,566	275,963	0
1990		244,707	213,853	263,566
1991	45,153	204,656	268,590	246,994
1992	252,202		242,831	
1993	316,943			
1994	185,300		186,400	
1995	151,500		150,500	
1996	151,000		156,500	
1997	150,000		148,500	
1998	150,600		151,100	
1999	151,500		138,000	
2000	152,500		152,500	
2001	101,170		101,040	
2002	152,124		153,122	
2003	151,415		155,435	
2004				
Total	2,111,407	872,929	3,113,120	1,241,868

Stocking history of CWT fish by strain at other locations

Year Class	Clay Banks	Green Lake	Juliens Reef	Seneca Lake
	Lewis Lake		Lewis Lake	
1984				
1985				
1988				
1989				
1990	15083			
1991				
1992				
1993				
1994	123000	59600		
1995	121500	37511		23389
1996	121400	60000		
1997	114900	60000		
1998		64000		
1999	116066			
2000		27000	32240	
2001		61024		
2002		60770		
2003		60300		
2004		62832		
Total	611949	553037	32240	23389

Lake Michigan studies using CWT recovery data

Rybicki 1990 MIDNR Research Report 1977

- relative survival, growth and straying among strains in Northern Refuge.

Madenjian and DeSorcie 1999 NAJFM

- growth, survival, and relative returns rates of Northern Refuge spawners.

McKee et al. 2004 NAJFM

- relative abundance, survival, growth and SL wounding between Seneca Lake and Marquette strains in the Southern Refuge.

Bronte et al. 2006 JGLR

- relative survival and growth of paired stocking of Lewis Lake strain stocked at different sizes at Clay Banks.

Bronte et al. 2007 NAJFM

- relative survival and site affinity of strains at all CWT stocking locations.

Summary of Results from Lake Michigan studies using CWT recovery data

Rybicki 1990 MIDNR Research Report 1977

- No difference in survival, growth or straying outside of the refuge (12-15%) among 1985 yrcl of Gull Island Shoal, Marquette, and Lewis Lake strains.

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Madenjian and DeSorcie 1999 NAJFM

- Growth of Marquette strain was slightly higher than for Lewis Lake strain; Marquette strain survival was at target levels; return rates were highest at Boulder, lowest at Richards and proportional to density.

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McKee et al. 2004 NAJFM

- Marquette had better survival than Seneca prior to age 3 but were similar thereafter; 1984 year-class survived better than the 1985 year-class prior to age 3 but were similar thereafter; emigration from Sheboygan Reef to near shore was similar for both strains but was higher for the 1984 yrcl than the 1985 yrcl; mean relative abundance of 1984 and 1985 yrcls of both strains did not decline with age suggesting very low mortality; growth in length and sea lamprey wounding was similar for both strains.

Summary of Results from Lake Michigan studies using CWT recovery data

Bronte et al. 2006 JGLR

- growth and relative survival of standard (18-20 fish/lb) and enhanced fish (10-12 fish/lb) was not significantly different at Clays Bank for Lewis Lake fish.

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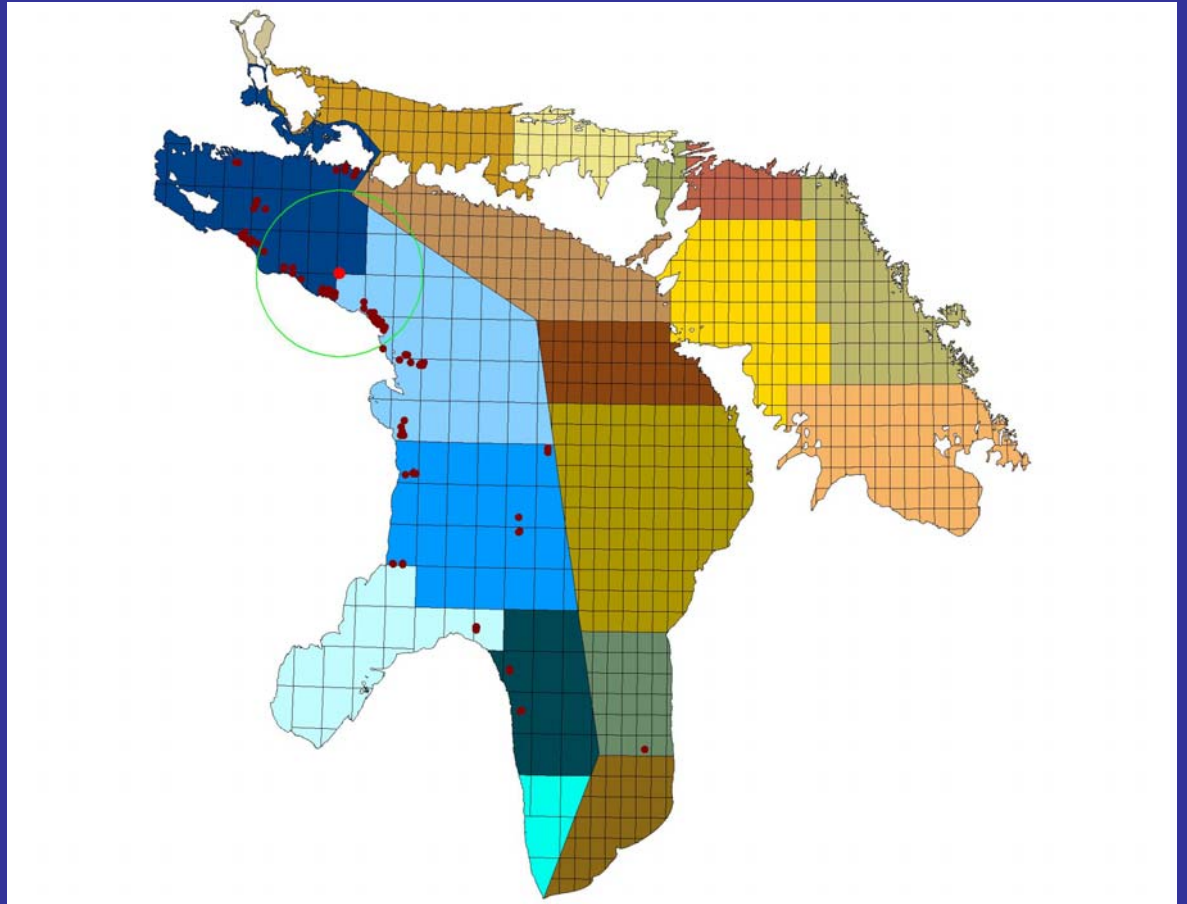
- relative survival to adults of Senecas was better than Lewis Lake and Marquette; most fish returned as adults to the site of stocking or to a site nearby; dispersal from stocking locations was about 100 km and similar among strains. Most fish stocked offshore spawned offshore and most fish stocked near shore spawned near shore.

New Lake Michigan studies using CWTs

New stocking strategies to be implemented with the revised restoration plan (Dexter et al. 2008)

- stocking off-reef versus on-reef comparisons
- continued strain evaluations
- fall fingering versus yearling comparisons
- complete CWT of all lake trout for revised movement matrix (future)

...on to Lake Huron.....



Lake Huron—History

- Since 1973, the Service has stocked approximately 48 million lake trout in US waters of Lake Huron.
- About 7.2 million hatchery lake trout have been tagged with CWT's ($\approx 15\%$) for various studies/assessments.



Lake Huron—Original Objectives

- Strain Comparison Study
 - Began in 1985 at the Drummond Island Refuge and Six Fathom Bank to evaluate the performance (growth, sea lamprey wounding, survival, contribution to the spawning stock, contribution to wild progeny) of paired releases of Seneca Lake, Marquette-Superior, and Jenny Lake strains of lake trout.

Lake Huron—Original Objectives

- Mid-lake Reef Evaluations
 - Began in 1985 at Six Fathom Bank and in 1999 at Yankee Reef to evaluate if lake trout stocked in sufficient numbers as yearlings and protected from fishing will reproduce successfully enough to generate self-sustaining populations (became basis for Lake Huron pulse stocking proposal).

Lake Huron—Original Objectives

- Movement Study
 - Began in 1992 at 4 sites—Adams Point, Middle Island, Sturgeon Point, Point Au Barques—to quantify movement and dispersal patterns of hatchery lake trout across the lake.
 - Aided in determining management unit specific emigration/immigration rates for catch-at-age models.
 - Movement fish (all LLW strain) planted in 1992, 1994, 1996, 1998, 2002, 2003, 2004, and 2005.
 - In addition, we also assessed the movement of CWT lake trout planted at Drummond Island and Six Fathom Bank, although strains varied at these sites.

Lake Huron—Original Objectives

- Quality at Release Study
 - Began in 1996 at 4 sites—Adams Point, Middle Island, Sturgeon Point, Point Au Barques—to compare the lakewide post-stocking performance of enhanced quality (approx. 10 per lb) lake trout with the historical “standard” (approx. 20 per lb) fish produced in the federal hatchery system.
 - All fish were LLW from Jordan River NFH.

Lake Huron—What Was Done

- CWT lake trout heads were collected from agency assessment nets, commercial fishing operations, and recreational fishers.
- Sufficient return numbers were obtained for all studies.
- All CWT returns were compiled in a LHTC common CWT database.



Lake Huron—Results

- Strain Comparison Study
 - Data analyses continues to show significantly lower mortality rates for Seneca Lake lake trout than for Marquette-Superior and Jenny Lake strains of lake trout.
 - This was mainly due to lower rates of lamprey induced mortality on Seneca Lake strain trout.
 - Growth rates were similar among strains.
 - All strains did contribute to the spawning population, but contributions to wild progeny were low.

Lake Huron—Results

- Mid-lake Reef Evaluations
 - Male and female lake trout in spawning condition have been observed offshore at both Six Fathom Bank and Yankee Reef in high densities, although Yankee Reef densities have been declining recently.
 - Wild YOY lake trout have been sampled in some years.
 - Wild lake trout have begun to recruit to the adult population in increasing abundance on Six Fathom Bank in recent years.
 - Seneca Lake strain trout survive better than other strains.

Lake Huron—Results

- Movement Study
 - We produced a movement matrix to adjust management unit specific stocking numbers for emigration/immigration in catch-at-age models used to set lake trout harvest limits.
 - Movement patterns (both distance and compass direction) varied by stocking site, year class, fish age, and strain.
 - See next slide for an example of effort adjusted returns for the Adams Point stocking site.

Adjusted for
sampling effort

Avg. dist. trav. = **21.8 mi**

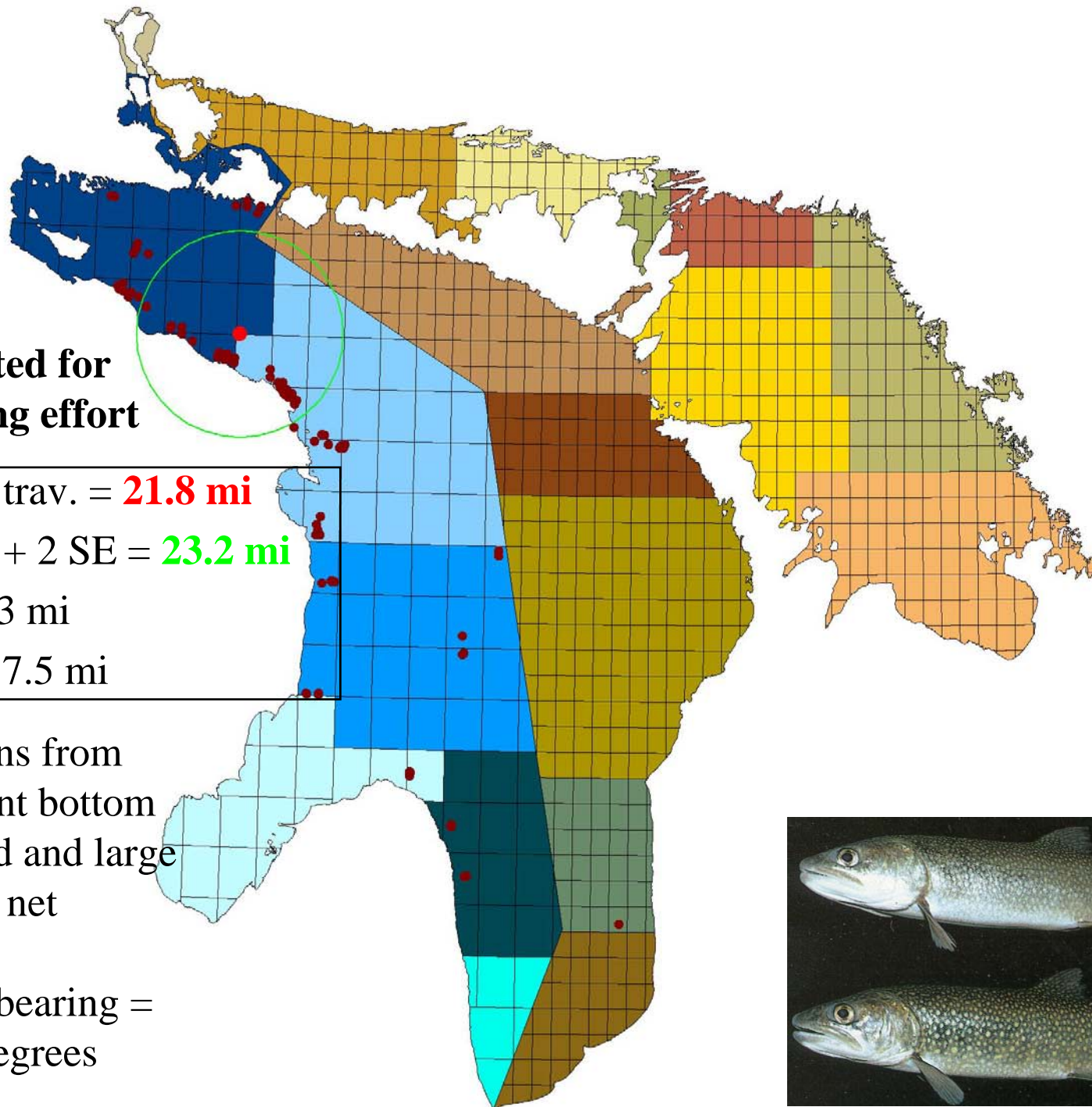
Avg. dist. + 2 SE = **23.2 mi**

Min. = 5.3 mi

Max. = 157.5 mi

592 returns from
assessment bottom
set graded and large
mesh gill net

Average bearing =
221 degrees



Lake Huron—Results

- Quality at Release Study
 - Both a Chi Square and Wilcoxon Analysis showed that overall the enhanced quality yearling lake trout survived better than the “standard” quality lake trout in Lake Huron.
 - However, the enhanced quality fish did not survive better for every year class at every stocking site.
 - Results only apply to LLW strain reared at Jordan River NFH.

Lake Huron—New Studies

- Repeat of movement study to assess suspected changes in distribution and dispersal of lake trout due to physical changes in Lake Huron.
- Study to monitor and assess performance of Parry Sound strain fish currently set to be stocked in 2011 ($\approx 500,000$ yearlings) in place of Lewis Lake strain.



Lake Huron—New Studies

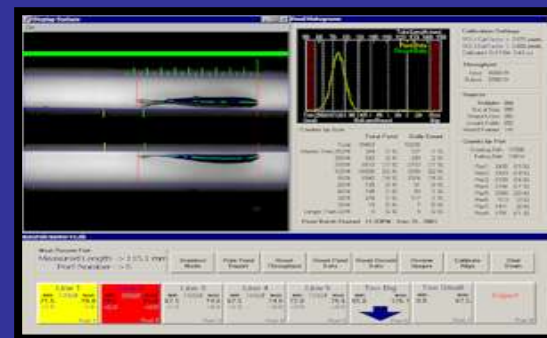
- Evaluation of pulse stocking strategy versus current “best reef” strategy (if pulse stocking is approved by the Lake Huron Committee).
- Evaluations of differential performance (if any) of lake trout among federal hatcheries.



Great Lakes Mass Marking Initiative

Report to the Council of Lake Committees
Great Lakes Fishery Commission

Charles R. Bronte, U.S. Fish and Wildlife Service
U.S. Co-chair, Implementation Task Group



Great Lakes Mass Marking Initiative

What is it?

A comprehensive, coordinated fish tagging/marking and data recovery program involving all state, tribal, federal, and provincial agencies that stock salmon and trout into the Great Lakes and its tributaries.



=



Great Lakes Mass Marking Initiative

What will it do?

Provide tagging/marking services for 30.2 million salmon and trout at 49 hatcheries across the Great Lakes basin, and a system to collect, process, and cooperatively analyze return data to assist agencies in evaluating the economic and biological impact of their stocking programs.



Great Lakes Mass Marking Initiative

How big will the program be?

Agency	Facilities	Fish (millions)	
MIDNR	6	7.7	
FWS	4	5.8	
WIDNR	9	4.3	
OMNR	6	3.5	
NYDEC	3	3.3	
NGO (Ontario)	11	1.8	
PABFC	3	1.3	
INDNR	2	1.0	
ILDNR	1	0.7	
MNDNR	2	0.3	
OHDNR	1	0.2	
RCFD (tribe)	1	0.1	
			Totals
			49 hatcheries
			30.2 million fish

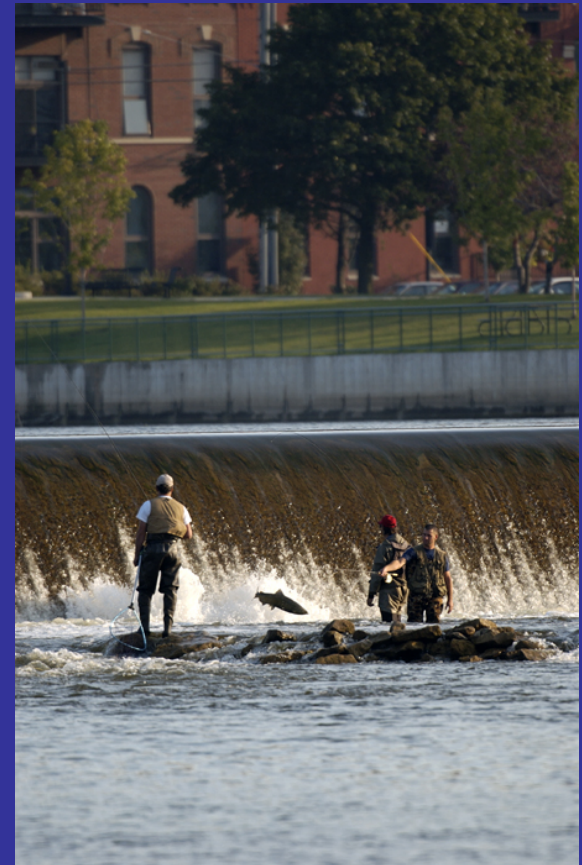
Great Lakes Mass Marking Initiative

How big will the program be?

Proposed number of fish stocked
in the Great Lakes per year

<u>Species</u>	<u>Millions</u>
Chinook salmon	9.3
Lake Trout	8.8
Steelhead	5.2
Coho salmon	2.9
Brown Trout	2.8
Atlantic salmon	0.7
Brook trout	0.3
Splake	0.2
Total	30.2

(25.6 US; 4.6 CN)



Great Lakes Mass Marking Initiative

Who will do it?

U.S. - U.S. Fish and Wildlife Service – Fish and Wildlife Conservation Offices

Canada – Ontario Ministry of Natural Resources



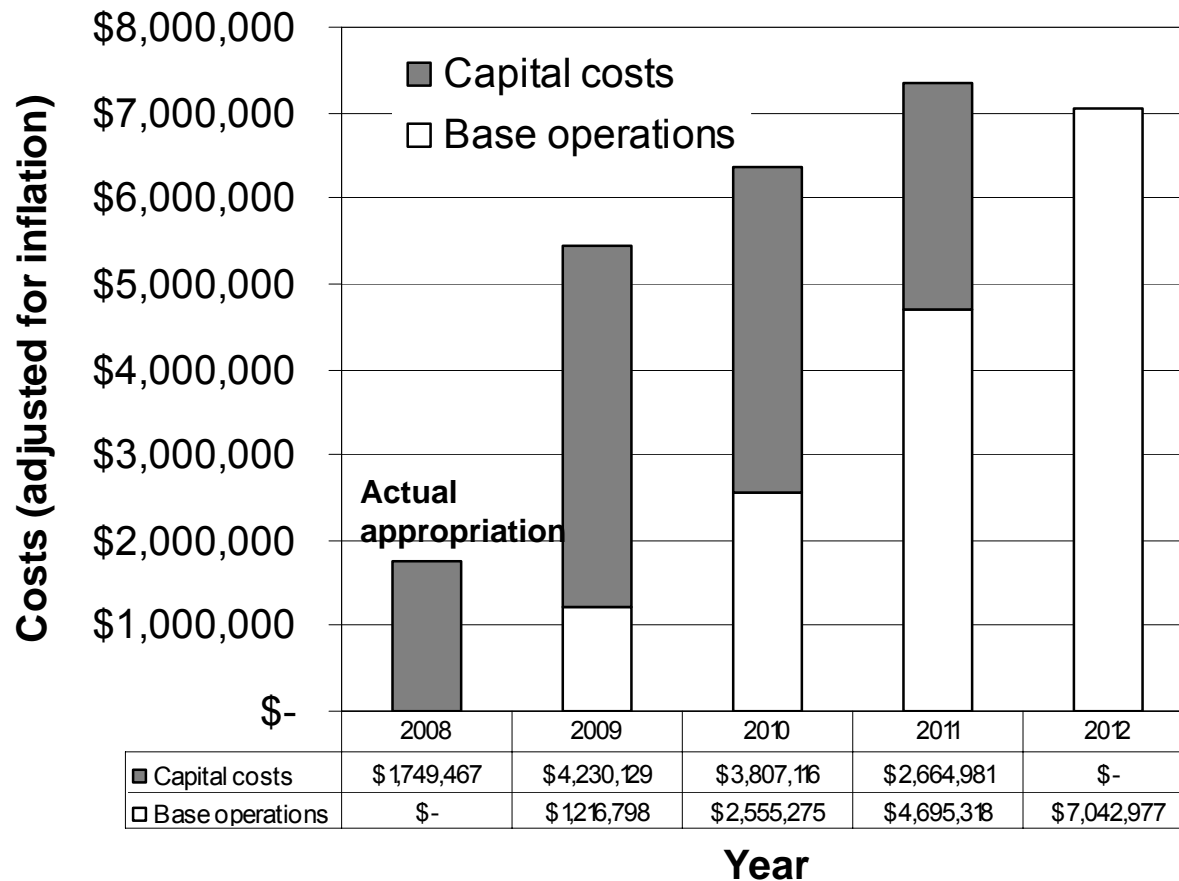
Great Lakes Mass Marking Initiative

How much will it cost?

	April 2005 (millions)	Dec 2007 (millions)
Capital equipment	\$ 12.2	\$ 13.7
Personnel (perm and temp)	\$ 1.6	\$ 2.5 (36%)
Travel	\$ 0.0	\$ 0.2 (9%)
CWT	\$ 1.2	\$ 2.2 (33%)
Operations/supplies	\$ 0.4	\$ 1.6 (22%)
Total annual operation costs	\$ 3.1	\$ 6.5
Grand total	\$ 15.4	\$ 20.6

Great Lakes Mass Marking Initiative

How much will it cost? US waters only.



Costs adjusted for inflation

Equipment - \$12.4 million

Operations

(fully funded) - \$ 7.0 million

Great Lakes Mass Marking Initiative

How does it work?

AutoFish SCT Mass Marking Trailer



Auto fish - a tool for handling live juvenile fish without anesthetic

Sorts – measures total length and counts

Clips – excises the adipose fin

Tags – snout tagged with CWT

Great Lakes Mass Marking Initiative

How does it work?



- process up to 60,000 fish/8 hr shift.
- fish are never dewatered
- 98% or better tag retention
- 99% or better Ad Clip
- far superior to manual methods
- accurate counts

Great Lakes Mass Marking Initiative

USFWS
Region 3

Responsible for managing and administering funds from Congress. Regional Director will have performance objectives tied to the funding that have to be met.

Great Lakes Mass Marking Initiative



Provide overall general direction and guidance to the program to insure information needs of national, basin-wide or lake-wide interest are met.

Great Lakes Mass Marking Initiative



Made up of key fishery and hatchery managers in each jurisdiction that are able direct jurisdictional resources to facilitate tagging and data collection activities of the Great Lakes Fish Marking Lab. Insure results are reported back to CLC.

Great Lakes Mass Marking Initiative



Staff, based on GLRMRC needs, works directly with research and field biologists to develop experimental designs specific to management questions. Key tagging staff work directly with hatchery personnel to insure efficient tagging sessions and smooth transitions among facilities. Provide marking and recovery services in US waters.

Great Lakes Mass Marking Initiative

Total staffing needs

Program Coordinator	1	Provide overall program coordination (US and Canada), all marking services, head processing, database and programming services, head recovery, experimental design and analytical services, ownership and maintenance of all equipment in US waters. OMNR will own, operate and maintain their equipment. All technical services (database, head shop, statistician) will be available to them.
Biostatistician	1	
Database administrator	1	
Tag crew supervisor	4	
Administrative technician	1	
Tag crew technicians	10	
Part-time assistant technicians	4	

Great Lakes Mass Marking Initiative



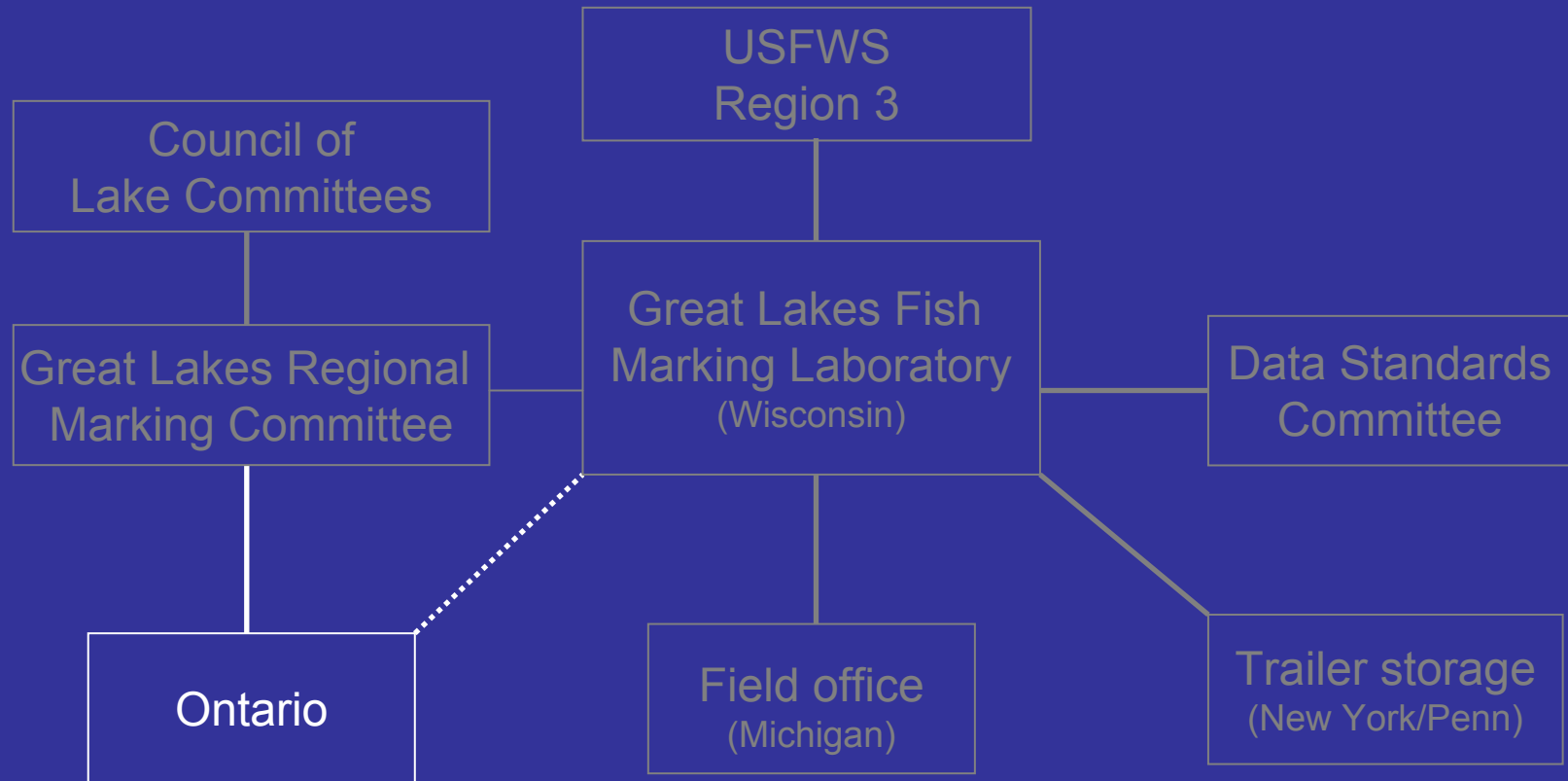
Database manager works directly with agency data managers to insure efficient and timely transfers of data. Team establishes data table structures to insure maximum data resolution, and meet needs of all possible study plans. Develops custom report outputs per study plan and agency needs.

Great Lakes Mass Marking Initiative



Satellite stations will meet tagging and data collection needs for MI, OH, NY, PA. MN, WI, IL, IN will be covered by the main lab.

Great Lakes Mass Marking Initiative



OMNR will provide tagging and data collection services in Canada. Will be represented on GLRMRC. Head shop, database, and analytical services available to them as per US agencies.

Great Lakes Mass Marking Initiative

First autoFish trailer to be delivered this week. First manual trailer to be delivered by December.

GLRMRC - TOR being developed.

Additional appropriations being sought by CLC and GLFC.

Stay tuned----more to come!

Read all about it at:

http://www.glfc.org/boardcomm/clc/Mass_marking_report_CLC2008.doc

