AN OBSERVATIONAL STUDY OF PFD WEAR RATES BY RECREATIONAL BOATERS DURING THE SUMMER OF 2007

FINAL REPORT

January 2008

Prepared for:
Minnesota Department of Natural Resources
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Monday, January 28, 2008

Minnesota Department of Natural Resources
Attn: Tim Kelly
OMBS, Box 10
500 Lafayette Road
St. Paul, Minnesota 55155-4010
(651) 259-5540
tim.kelly@dnr.state.mn.us

Dear Tim Kelly,

Please find attached the 2007 Personal Flotation Device (PFD) Wear Rate Study Final Report. The Final Report has been prepared to meet the requirements of Deliverables #9 and #10.

If you have any questions or require additional information, please contact me at 651 482-9680 or by email at greg@thomtechdesign.com.

Sincerely,

Gregory E. Thompson
President

Table of Contents

I. UNDERSTANDING

A. Introduction. The Minnesota Department of Natural Resources (DNR) desired to prepare and execute an observational study of PFD wear rates by recreational boaters during the summer of 2007. This document provides the results and procedures used to complete this study.

The PFD wear rates by recreational boaters study borrowed heavily from similar studies conducted for the U. S. Coast Guard. The PFD wear rate study involved direct observation of boaters from shore. Two of the desired outcomes of the study are listed in Table 1 below.

Outcomes
1. Provide information to the DNR's boating safety program.
2. Produce information that can be compared directly to the Coast Guard findings.

Table 1: Two Desired Outcomes of the Study

B. Project Goal. The goal of the project was to measure the frequency with which Twin Cities recreational boaters wear PFDs, depending on type of lake, type of weather and water conditions, type of boat and propulsion system, movement of the boat, type of boating activity, and age and gender of the boater. Figure 1 illustrates the categories measured and recorded of the boater PFD wear rate depending on the environment, boat, and boater characteristics.

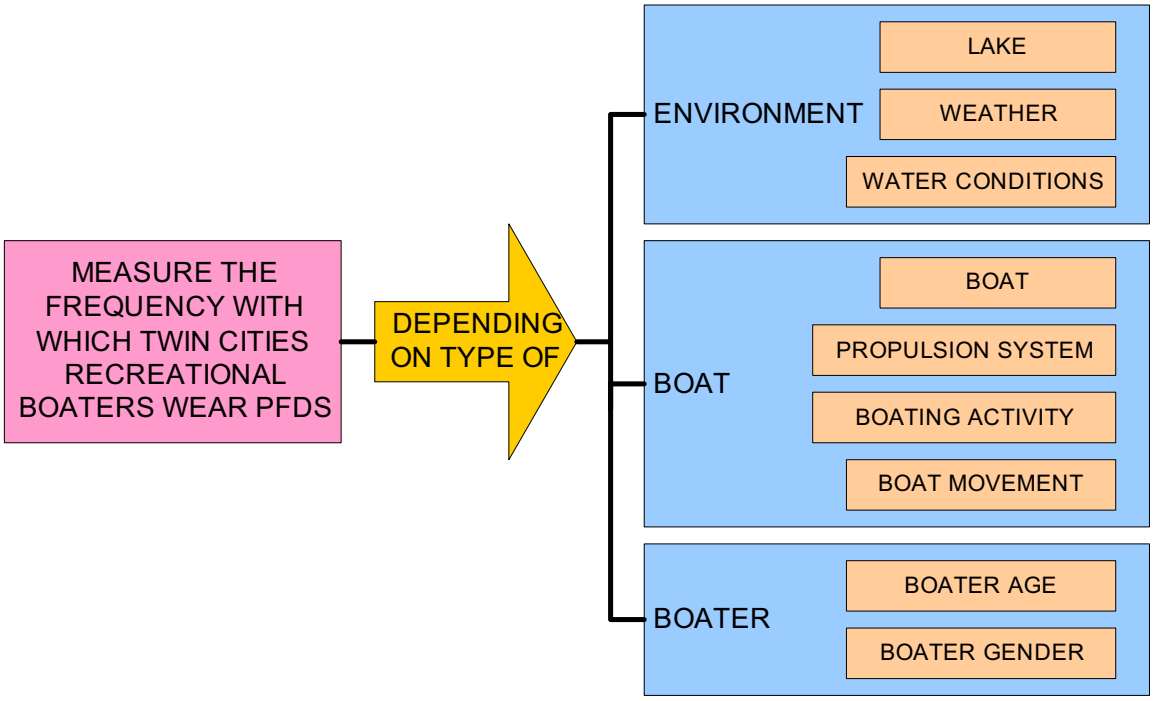


Figure 1: Program Goal

D. Methodology. Thompson Engineering Company (TEC) conducted the pilot study. TEC is a proven environmental field data collection agency specializing in environmental and natural resource field research and study programs.

The methodology for this project took its premise from previous US Coast Guard studies on the use of personal flotation devices (PFD). The tasks for the project follow a proven outline and profile employed on similar projects. Figure 2 provides a block diagram of the task flow for this project. The methodology for this project is illustrated by the task flow diagram.

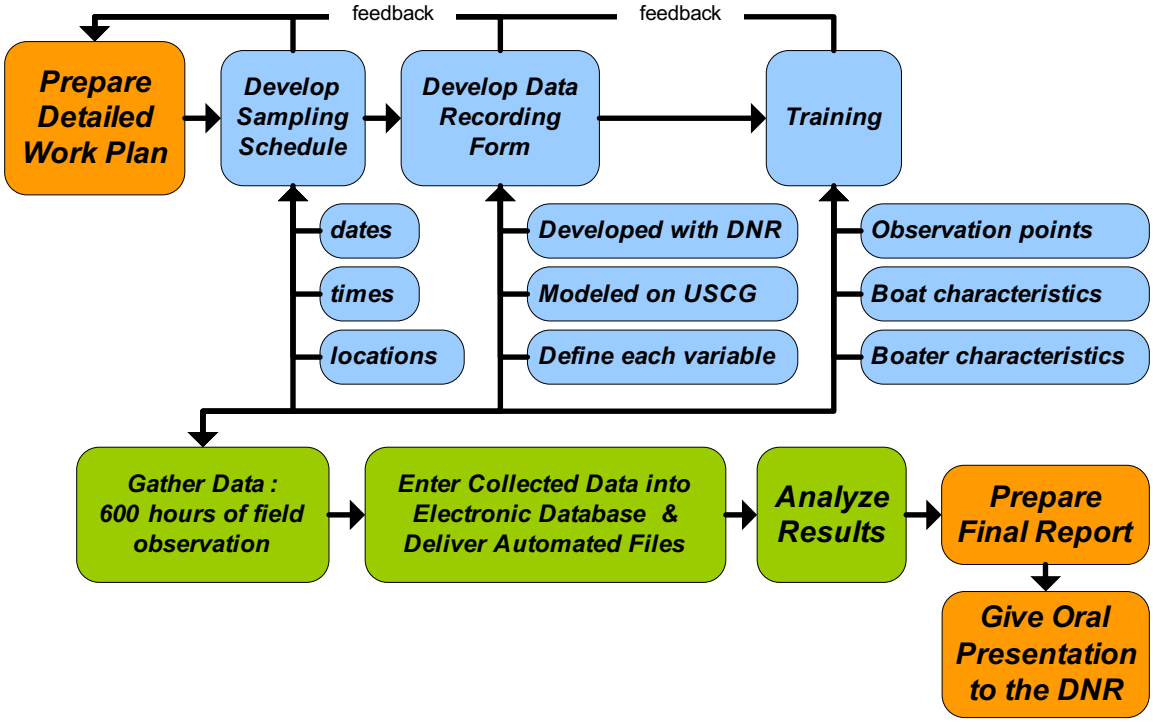


Figure 2: Project Task Flow

II. DESCRIPTION

A. Approach. Data gathering was conducted to meet the project objectives as described above. Data was gathered from direct observation of boaters based on the sampling plan, the data recording form, detailed training of observers, and the work plan.

Lakes were placed into clusters (see pages 13 and 14). Each cluster is a person-day of work; a cluster has 4 observation hours; one hour at each site. The clusters are sampled at rates that spread sampling effort to each of the lake classes, so results can be reported for each class; when classes are combined, results were use-weighted. The breakdown of 1996 boating use by lake class is:

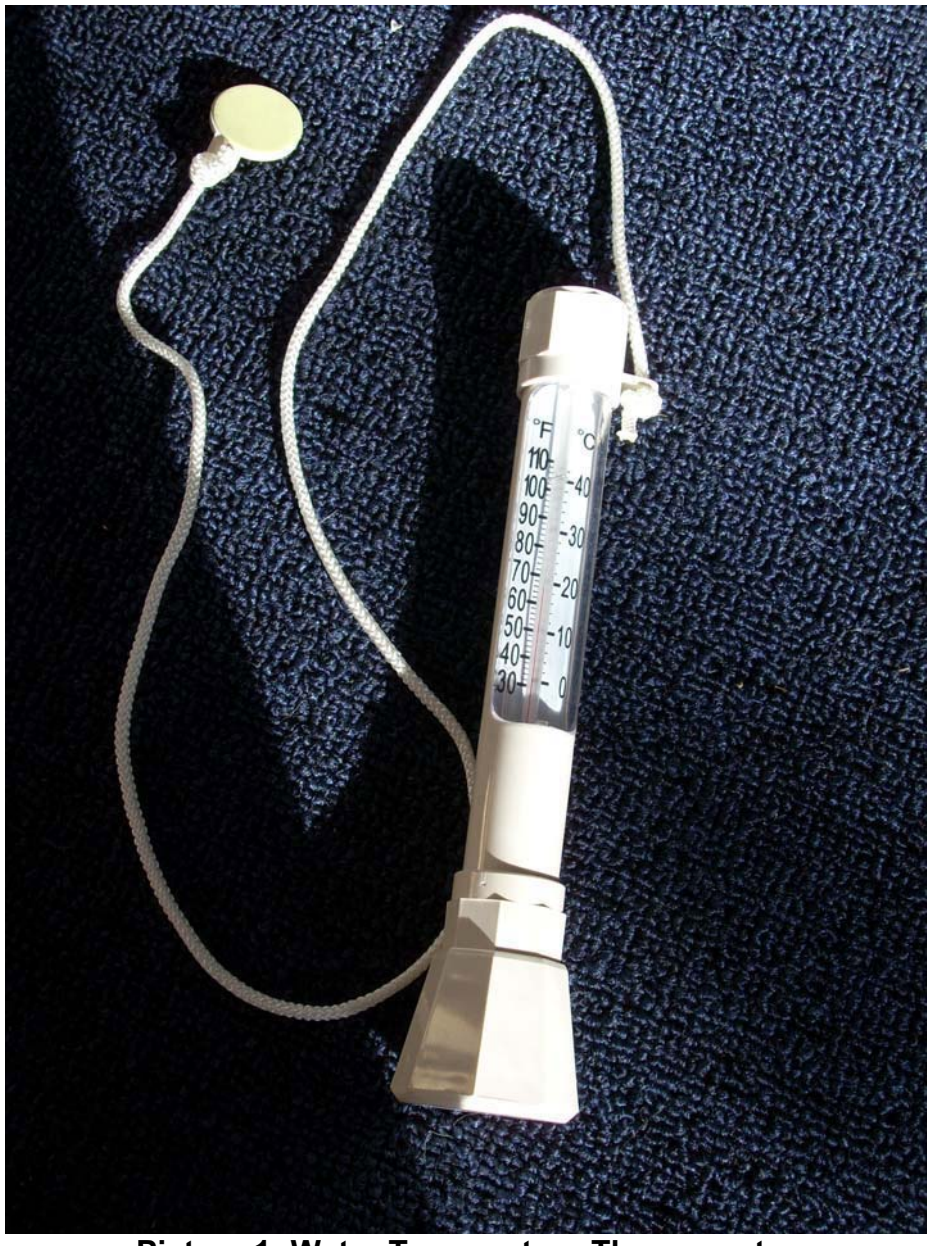
Minnetonka—30%, St. Croix—18%, Cat1—11%, Cat 2—15%, Cat 3—26%. See the Sampling Plan included as Attachment A.

B. Project Tasks. The project tasks that were accomplished are listed in Table 2 below.

#	Proposed Tasks	Thompson Engineering Action
1	Prepare a final, detailed work plan and submit for review, discussion and revision.	Prepared a detailed work plan that will include collection & analysis methods, data recording forms, and schedule.
2	Develop (with DNR assistance) a sampling schedule for the study period. The sampling schedule will specify specific dates, times, and locations for field observations.	This was an important task and included the locations, times & dates for observation. Considering variety, diversity, and comprehensive coverage of the boaters/lakes.
3	Conduct training for observers to assure consistency, accuracy, and compliance with sampling schedule and data recording form.	This task provided the observers with detailed training on accurately recording boat & boater characteristics & the environment.
4	Develop (with DNR assistance) a data recording form for the field observations of boaters.	These forms were used for recording data and then computerizing the data into a database.
5	Collect data from boater observation based on the sampling schedule and employing the data recording form.	There were 600 hours devoted to direct observation, 200 hours during each of 3 periods of observation.
6	Computerize collected data and deliver automated data files to the DNR in a format it requires.	Entered all data into a database and provided the data in an electronic format to the DNR.
7	Analyze study results.	Conducted an analysis on the data, drawing conclusions in concert with the DNR.
8	Prepare a report on study methodology and study results. Deliver a digital copy of the report to the DNR, along with 10 printed copies of the report.	Final report that includes project methodology, results, and analysis. All project materials will be boxed and delivered to DNR when requested. A digital copy and 10 additional copies will be provided to DNR.
9	Orally present the report to the DNR at a meeting.	Oral presentation that includes a power point file for a DNR meeting. The presentation would be approximately 30 minutes.

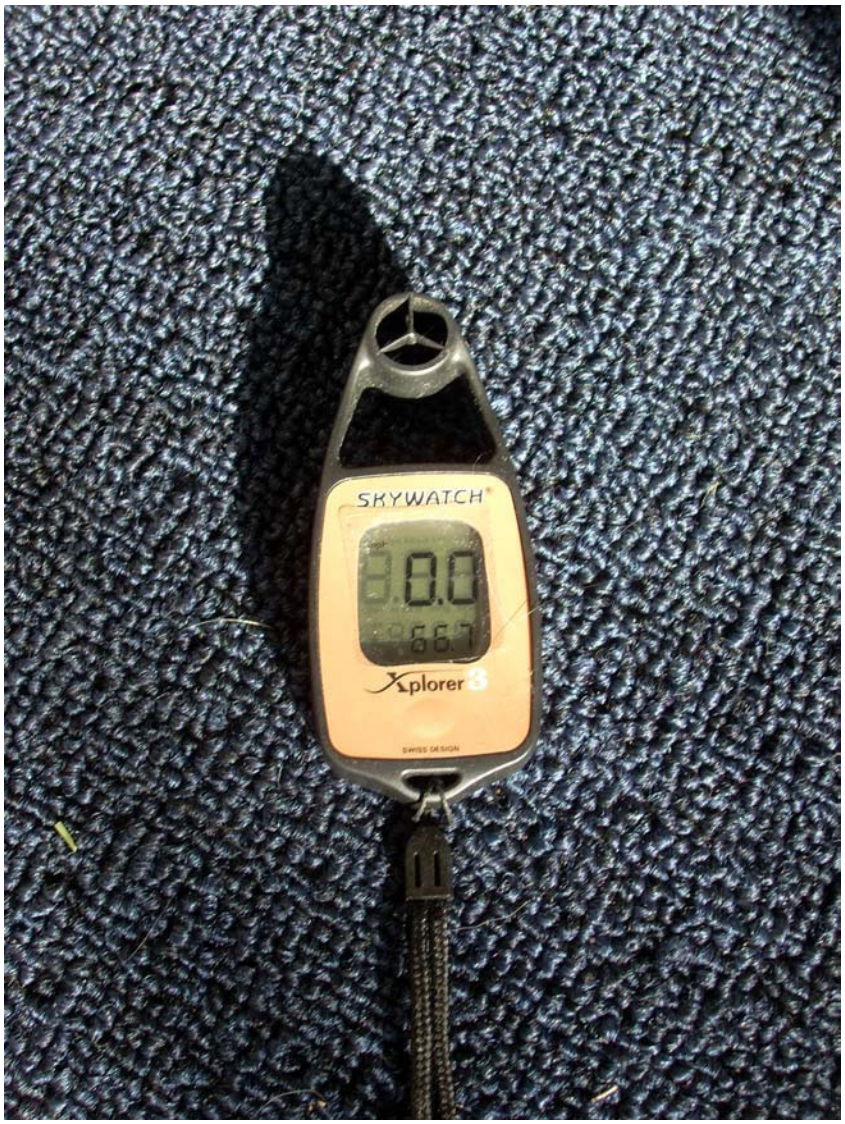
Table 2: Project Task List

C. Measure the Frequency with Which Recreational Boaters Wear PFDs.
The study included detailed observations of boaters from the shore and determined the frequency with which boaters wear PFDs. The study involved the formulation of a sampling plan that provided the dates and times for visiting lakes and specified observation points. This included the observer kit containing binoculars, stool (lawn chair), clipboard, pen/pencil, boat graphics, PFD descriptions, water, and observer protection equipment (see pictures 1, 2, & 3). Visitation places, dates, and times were coordinated to maximize observer time and minimize travel and setup time while at the same time maintaining the necessary overall coverage, variety, and diversity of the observations.



Picture 1: Water Temperature Thermometer

Courses were designed for three parallel and distinct routes that were executed by an observer in accordance with the sampling plan. The instruments for each of the three observers were binoculars, water temperature sensor, air temperature sensor, wind speed detector, and a compass. In addition, creature comforts completed the kit along with the necessary recording equipment (clipboard, pen/pencil, & site/boat forms) for collecting the data required for the study.



Picture 3: Wind-speed & Air Temperature Thermometer

Attachment B (Observation Guide) provided the instructions and guidelines for ensuring the consistency and procedural protocol for recording data, observing boat, boater, and weather characteristics.

Attachment C provided the site worksheet and the boat worksheet that was utilized during the observation period.

Picture 3: Binoculars Used by Observers

D. DNR Project Support. The following items were provided by the DNR to assist in the completion of this project. The DNR has assisted and/or completed the following:

1. Provided a single point of contact for the DNR for reporting purposes and issues, should they arise. This would include determining the data formats required of state agencies.
2. Assisted in determining the best way to observe boaters, select possible observation sites, and in preparation of the data recording form.

3. Recommended training curriculum for the educating of potential observers in boater and boat characteristics and the use of the data recording form with the sampling plan.
4. Conducted training on boat and life vest characteristics.
5. Helped in clearly defining each variable of the data recording form.
6. Worked with TEC to determine good observation points for each lake visited.
7. Assisted in the preparation of the sampling plan.

III. PROJECT SCHEDULE

A. General. The original project schedule is provided in Figure 3. The actual scheduled followed closely the planned schedule. The final report was delayed for administrative reasons.

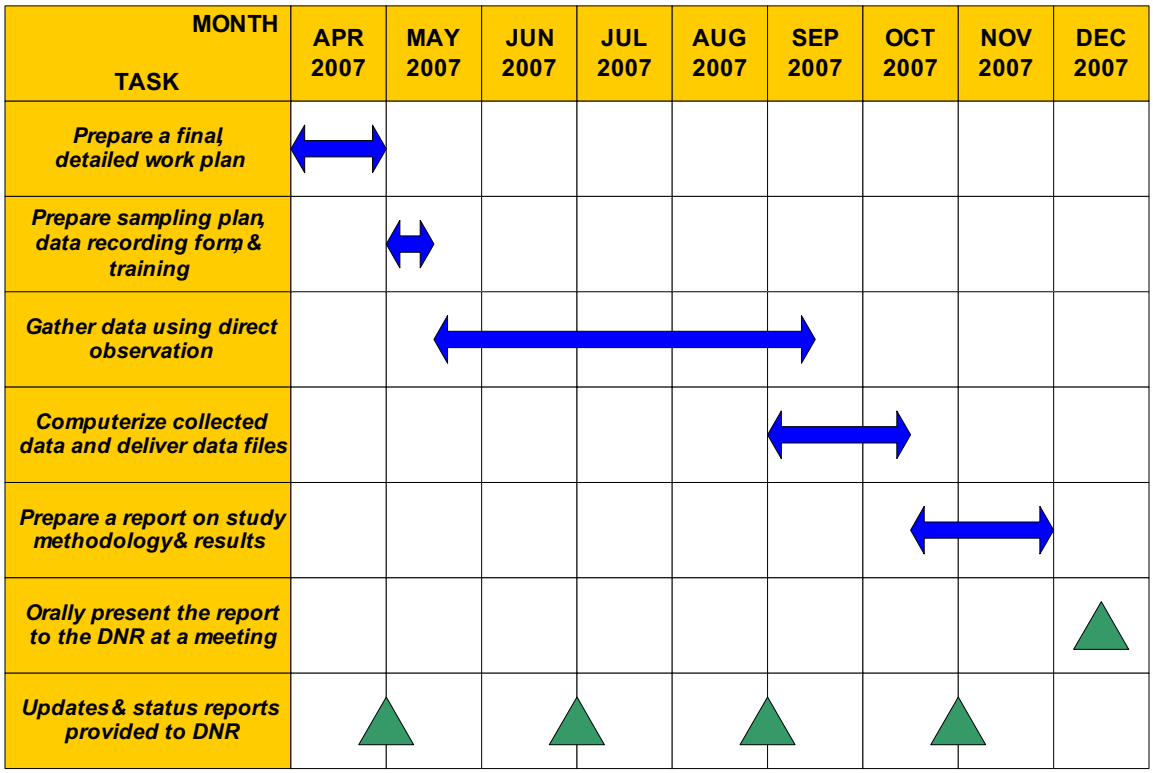


Figure 3: Proposed Schedule

B. Deliverables Schedule. See Figure 4 below.

#	Proposed Delivery Schedule	Date
1	Final, detailed work plan.	May 2007
2	Sampling schedule for the study period.	May 2007
3	Training for observers.	May 2007
4	Data recording form.	May 2007

#	Proposed Delivery Schedule	Date
5	Collect 1/3 data from the beginning of the observation period to the end of June 2007.	June 2007
6	Collect 1/3 data from July 2007, the middle portion of the observation period.	July 2007
7	Collect 1/3 data from August 2007 to end of observation period.	September 2007
8	Computerize data & deliver automated data files.	October 2007
9	Analyze study results.	November 2007
10	Report on study methodology and study results.	December 2007
11	Oral presentation of the report.	December 2007

Table 3: Project Deliverables Schedule

C. Detailed Scheduling for Weekends/Holidays. See Table 4 below.

Weekends/holidays					
Sequence	Week	Date	Period	Time of day	Cluster
1	1	19-May-07	1	early	C4
2	1	19-May-07	2	early	C7
3	1	20-May-07	1	late	M
4	1	20-May-07	2	late	C6
5	2	26-May-07	1	early	S
6	2	26-May-07	2	late	C7
7	2	28-May-07	1	late	C2
8	2	28-May-07	2	early	C7
9	3	2-Jun-07	1	late	C5
10	3	2-Jun-07	2	late	C7
11	3	3-Jun-07	1	early	M
12	3	3-Jun-07	2	early	C4
13	4	9-Jun-07	1	early	S
14	4	9-Jun-07	2	early	M
15	4	10-Jun-07	1	late	S
16	4	10-Jun-07	2	late	C1
17	5	16-Jun-07	1	early	M
18	5	16-Jun-07	2	early	C7
19	5	17-Jun-07	1	late	S
20	5	17-Jun-07	2	late	M
21	6	23-Jun-07	1	early	C6
22	6	23-Jun-07	2	late	C2
23	6	24-Jun-07	1	late	S
24	6	24-Jun-07	2	early	C3
25	7	30-Jun-07	1	late	C5

Weekends/holidays					
Sequence	Week	Date	Period	Time of day	Cluster
26	7	30-Jun-07	2	early	S
27	7	1-Jul-07	1	early	C6
28	7	1-Jul-07	2	late	C3
29	8	7-Jul-07	1	early	C2
30	8	7-Jul-07	2	late	C4
31	8	8-Jul-07	1	late	M
32	8	8-Jul-07	2	early	C6
33	9	14-Jul-07	1	late	C4
34	9	14-Jul-07	2	late	S
35	9	15-Jul-07	1	early	S
36	9	15-Jul-07	2	early	C6
37	10	21-Jul-07	1	late	C4
38	10	21-Jul-07	2	early	M
39	10	22-Jul-07	1	early	M
40	10	22-Jul-07	2	late	C3
41	11	28-Jul-07	1	late	C1
42	11	28-Jul-07	2	early	S
43	11	29-Jul-07	1	early	M
44	11	29-Jul-07	2	late	C3
45	12	4-Aug-07	1	early	C7
46	12	4-Aug-07	2	early	C5
47	12	5-Aug-07	1	late	C4
48	12	5-Aug-07	2	late	M
49	13	11-Aug-07	1	early	S
50	13	11-Aug-07	2	late	M
51	13	12-Aug-07	1	late	C5
52	13	12-Aug-07	2	early	C3
53	14	18-Aug-07	1	late	C3
54	14	18-Aug-07	2	late	C5
55	14	19-Aug-07	1	early	C7
56	14	19-Aug-07	2	early	C4
57	15	25-Aug-07	1	late	M
58	15	25-Aug-07	2	early	S
59	15	26-Aug-07	1	early	S
60	15	26-Aug-07	2	late	C3
61	16	1-Sep-07	1	early	C6
62	16	1-Sep-07	2	late	C7

Weekends/holidays					
Sequence	Week	Date	Period	Time of day	Cluster
63	16	2-Sep-07	1	late	C3
64	16	2-Sep-07	2	early	S
65	17	8-Sep-07	1	late	C7
66	17	8-Sep-07	2	late	C1
67	17	9-Sep-07	1	early	M
68	17	9-Sep-07	2	early	C1
69	18	15-Sep-07	1	late	C7
70	18	15-Sep-07	2	early	C2
71	18	16-Sep-07	1	early	C3
72	18	16-Sep-07	2	late	C7

Table 4: Weekends/Holidays

D. Detailed Scheduling Weekdays. See Table 5 below.

Weekdays				
Sequence	Week	Date	Time of day	Cluster
1	1	21-May-07	early	M
2	1	22-May-07	late	C1
3	1	24-May-07	early	S
4	1	25-May-07	late	C7
5	2	29-May-07	late	C2
6	2	30-May-07	early	C7
7	2	31-May-07	early	M
8	2	1-Jun-07	late	C5
9	3	4-Jun-07	late	C3
10	3	5-Jun-07	early	C1
11	3	6-Jun-07	early	C7
12	3	7-Jun-07	late	C3
13	4	11-Jun-07	early	C7
14	4	12-Jun-07	late	S
15	4	13-Jun-07	early	C6
16	4	15-Jun-07	late	C3
17	5	19-Jun-07	late	M
18	5	20-Jun-07	early	S
19	5	21-Jun-07	early	C4
20	5	22-Jun-07	late	S
21	6	25-Jun-07	late	C6
22	6	27-Jun-07	early	M
23	6	28-Jun-07	early	C1

Weekdays				
Sequence	Week	Date	Time of day	Cluster
24	6	29-Jun-07	late	M
25	7	2-Jul-07	late	C7
26	7	3-Jul-07	early	C7
27	7	5-Jul-07	late	C6
28	7	6-Jul-07	early	C4
29	8	9-Jul-07	early	M
30	8	10-Jul-07	late	S
31	8	12-Jul-07	early	M
32	8	13-Jul-07	late	M
33	9	16-Jul-07	early	S
34	9	17-Jul-07	late	M
35	9	18-Jul-07	early	C7
36	9	20-Jul-07	late	C1
Weekdays				
Sequence	Week	Date	Time of day	Cluster
37	10	23-Jul-07	early	C7
38	10	24-Jul-07	late	C4
39	10	25-Jul-07	early	C7
40	10	26-Jul-07	late	M
41	11	30-Jul-07	late	C6
42	11	1-Aug-07	early	C7
43	11	2-Aug-07	late	C4
44	11	3-Aug-07	early	C2
45	12	7-Aug-07	early	C5
46	12	8-Aug-07	late	C3
47	12	9-Aug-07	late	C3
48	12	10-Aug-07	early	C3
49	13	13-Aug-07	early	M
50	13	14-Aug-07	late	C3
51	13	15-Aug-07	late	C7
52	13	17-Aug-07	early	S
53	14	21-Aug-07	early	M
54	14	22-Aug-07	late	S
55	14	23-Aug-07	late	C5
56	14	24-Aug-07	early	M
57	15	27-Aug-07	late	C3
58	15	29-Aug-07	early	C2

Weekdays				
Sequence	Week	Date	Time of day	Cluster
59	15	30-Aug-07	early	M
60	15	31-Aug-07	late	M
61	16	4-Sep-07	early	C5
62	16	5-Sep-07	late	S
63	16	6-Sep-07	early	M
64	16	7-Sep-07	late	C6
65	17	11-Sep-07	late	C4
66	17	12-Sep-07	early	C6
67	17	13-Sep-07	late	C2
68	17	14-Sep-07	early	S

Table 5: Weekdays

E. Observation Sites. See Table 6 below.

Lake clusters for PFD observational study (each cluster is a person-day of work, a cluster has 4 observation hours; one hour at each site)						
Lake Number	Name	Cluster	Lake Class	Lake Acres	Number of observation sites	Observation sites (codes from Twin Cities Water Recreation Guide)
270133	Minnetonka	M	Minnetonka	14,034	4	Causeway shorefish site between Grays and Wayzata Bay;
						3 platform sites: H50, H51 and H53
St. Croix River	St. Croix River	S	St. Croix River	8,215	4	W22-access, W25-bankfish, W27-access, W24-platform
20026	Linwood	C1	Cat 3-PA	567	1	A15-platform
130041	Green	C1	Cat 3-PA	1,830	1	Access on south side
130053	Comfort	C1	Cat 3-PA	220	1	Access on north side
130012 & 130028	Chisago,S Lindstrom	C1	Cat 3-PA	1,594	1	Pier at north end
100009	Minnewashta	C2	Cat 1	763	1	C16-pier
100059	Waconia	C2	Cat 3-PA	3,196	1	C29-access
270067	Bryant	C2	Cat 2-PA	199	1	H2-pier
270137	Christmas	C2	Cat 2-PA	274	1	H8-access
190026	Marion	C3	Cat 3-PA	489	1	D17-pier
700120	Thole	C3	Cat 3-PA	131	1	S18-access
700026 & 700072	L & U Prior	C3	Cat 1	1,146	2	S13-pier, S14-access

Lake clusters for PFD observational study (each cluster is a person-day of work, a cluster has 4 observation hours; one hour at each site)						
					Number of	Observation sites
Lake Number	Name	Cluster	Lake Class	Lake Acres	observation sites	(codes from Twin Cities Water Recreation Guide)
270104	Medicine	C4	Cat 2-PA	924	1	H33-pier
270019	Nokomis	C4	Cat 2-PA	199	1	H63-pier
270031	Calhoun	C4	Cat 2-PA	416	1	H5-pier
270111	Eagle	C4	Cat 2-PA	470	1	H15-pier
620056	Owasso	C5	Cat 2-PA	360	1	R21-access
620057	Josephine	C5	Cat 2-PA	110	1	R10-access
620061	Turtle	C5	Cat 2-PA	444	1	R29-access
620078	Johanna	C5	Cat 2-PA	211	1	R9-pier
820052	Big Marine	C6	Cat 1	1,577	2	W4-access, W5-access
820159	Forest	C6	Cat 3-PA	2,206	1	W12-access
820163	Clear	C6	Cat 3-PA	400	1	W8-access
20006	Centerville	C7	Cat 3-PA	464	1	A2-access
820049	Big Carnelian	C7	Cat 3-PA	444	1	W3-access
820167	White Bear	C7	Cat 1	2,410	2	R32-access, R34-pier

Table 6: Observation Sites

IV. TABULATION OF OBSERVATIONS

The following results are provided by the analysis conducted by the DNR from the data set.

Boater-related observations (percentage base is the number of people observed = 17,697)			
Gender of boater		**Age of boater**	
Class	Percent	Range	Percent
Male	64%	0-5 years	1%
Female	35%	6-12 years	7%
Unknown	1%	13-17 years	10%
Missing data	0%	18-64 years	78%
Total	100%	65+ years	3%
		Missing data	0%
		Total	100%
PFD worn by boater		**Boater is a waterskier?**	
Class	Percent	Waterskier?	Percent
Old pfd	1%	Yes	1%
New pfd	16%	No	99%
Inflatable pfd	0%	Missing data	0%
No pfd worn	81%	Total	100%
Cannot tell if wearing pfd	1%		
Missing data	0%		
Total	100%		

Table 7: Boater-Related Observations

Boat-related observations
(percentage base is the number of people observed = 17,697)

Boat type		**Boat power type**	
Class	Percent	Class	Percent
Utility/fishing	26.2%	Outboard	44.4%
Runabout/spdboat	39.0%	Inboard/stern-drive	50.6%
Cabin cruiser	10.6%	Paddles/oars	3.0%
Houseboat	1.3%	Air fan	0.1%
Pontoon	12.7%	Sail only	1.2%
PWC	4.4%	Sail & motor	0.8%
Inflatable/raft	1.0%	Total	100.0%
Canoe	1.4%		
Kayak	1.2%		
Other	0.3%		
Sailboard	0.3%		
Day sailor	1.0%		
Cabin sailboat	0.6%		
Total	100.0%		

Boat movement		**Boat length**	
Class	Percent	Range	Percent
Cruising	48.7%	under 16 feet	20.5%
Sailing	1.2%	16-20 feet	63.7%
Row-paddling	2.7%	over 20 feet	15.7%
Drifting	35.4%	Total	100.0%
Anchored	10.0%		
Trolling	2.0%		
Total	100.0%		

Main activity observed on boat	
Class	Percent
Fishing	16.7%
Skiing/tubing	2.2%
Swimming	1.9%
Cruising	43.3%
Other	35.8%
Total	100.0%

Table 8: Boat-Related Observations

Ambient conditions for boater observations (percentage base is the number of people observed = 17,697)			
Air temperature (°F)		**Water temperature (°F)**	
Range	Percent	Range	Percent
51 to 60	2%	51 to 60	1%
61 to 70	9%	61 to 70	17%
71 to 80	26%	71 to 80	58%
81 to 90	37%	81 to 90	25%
91 or higher	26%	91 or higher	0%
Total	100%	Total	100%
Wind speed (mph)		**Water conditions**	
Range	Percent	Class	Percent
Calm	16%	Calm	65%
1 to 5	52%	Choppy	31%
6 to 10	26%	White caps	4%
Over 10	7%	Total	100%
Total	100%		
Visibility		**Sky conditions**	
Class	Percent	Class	Percent
Good	82%	Sunny	70%
Fair	17%	Partly cloudy	13%
Poor	1%	Cloudy	13%
Total	100%	Raining	4%
		Total	100%

Table 9: Ambient Conditions for Boater Observations

PFD Study Observation Statistics				
Breakdown	Number of one-hour observation blocks	Number of boats observed	Number of people observed	Number of people could observe whether wearing a PFD
Total	584	6,699	17,697	17,406
Month				
May	64	641	1,515	1,405
June	127	1,333	3,536	3,496
July	145	1,924	5,024	4,975
August	158	1,634	4,493	4,448
September	90	1,167	3,129	3,082
Day of week				
Weekend/holiday	299	4,790	12,961	12,741
Weekday	285	1,909	4,736	4,665
Time of Day				
Early (7:00 to 11:30)	200	1,913	4,828	4,765
Mid day (11:30 to 16:00)	216	2,750	7,445	7,312
Late (16:00 to 20:00)	168	2,036	5,424	5,329
Lake Class				
Lake Minnetonka	123	1,480	3,970	3,929
St. Croix River	103	1,811	5,105	5,061
Cat 1 (other large lakes; all have public access)	112	1,614	4,293	4,161
Cat 2-PA (remaining boating lakes in the more urbanized part of the metro area; all have public access)	101	563	1,158	1,149
Cat 3-PA (remaining boating lakes in the more rural part of the metro area; all have public access)	145	1,231	3,171	3,106

Table 10: PFD Study Observation Statistics

V. METHODOLOGY EVALUATION

The study found that the methodology was sound and the study delivered the required output. Figure 4 provides the recommended task flow, the main tasks are colored in gold with supporting data colored green.

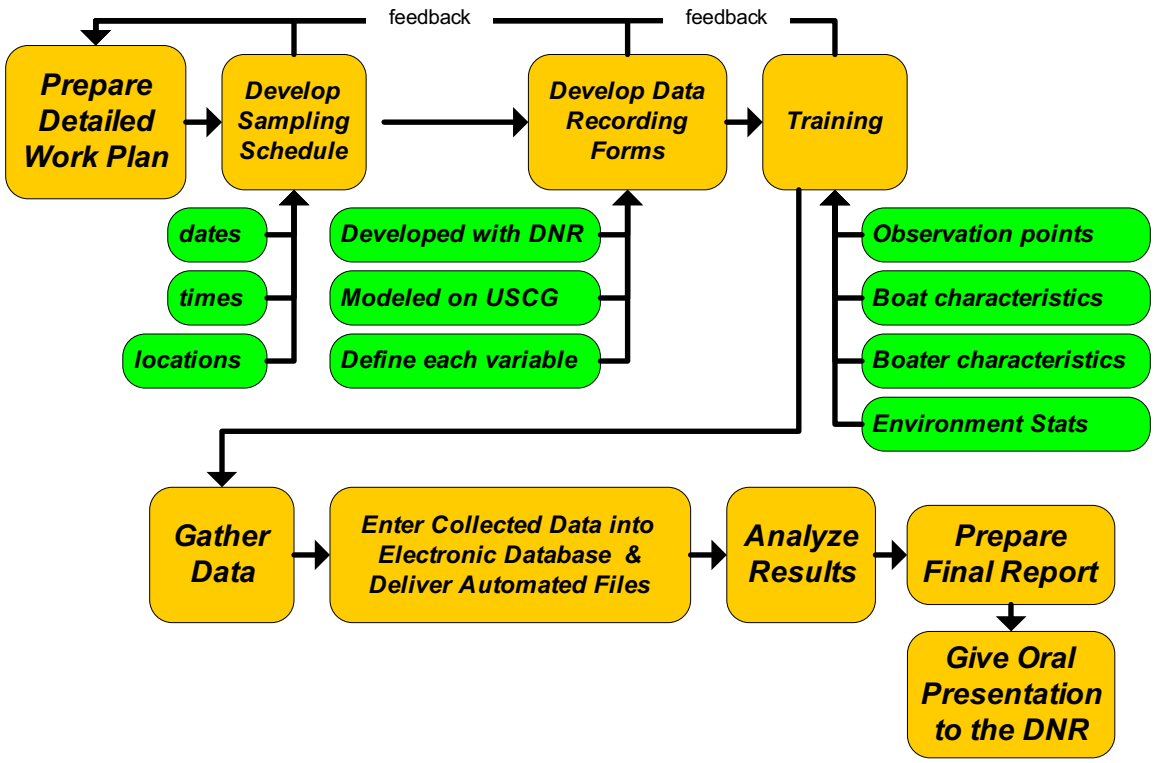


Figure 4: Methodology Task Flow

The preparation of the work plan and sampling schedule, before data is gathered, are essential for maintaining consistency and ensuring that the strata are sampled as needed. The Forms development is key to making the data gathering straightforward for the observers.

Training the observers together is important. It provides an equal starting off point that is essential for interpreting the different types of boats, conditions, boaters, and observation points. The data gathering was divided up into three sessions. The data was inputted and provided for initial evaluation after the first session and provided an opportunity to adjust if needed.

The methodology for this study was sound. The observers' goal was to collect 600 hours of data. It is possible that the amount of hours could have been reduced to achieve the same results, perhaps 400 hours. It was a very successful study. The boaters and people encountered at the observation points

were all cooperative. On occasion, at the most active observation points, it was difficult to find parking but this was soon remedied as the observers familiarized themselves with the area.

VI. SUMMARY

Please find attached the Sampling Plan in Attachment A and the Observation Guide in Attachment B. These were used by the data recorders as a procedural for collecting the data on wear rate for PFDs. Attachment C provides the Data Recording Sheets for the Boat Form and the Site Form. Attachment D was used to aid observers in boat and PFD types. Attachment E is the electronic spreadsheet with the data recorded from all the boat and site forms.

Attachment A – Sampling Plan
Attachment B – Observation Guide
Attachment C – Data Recording Worksheets
Attachment D – Photo Guide for Boat & PFD Type Recognition (distributed separately)
Attachment E – Data Set and Spreadsheet of all Data Collected (distributed separately)

Attachment A – Sampling Plan

Steps in creating the PFD study sampling schedule

1. Lakes were placed into clusters (see pages 18 and 19). Each cluster is a person-day of work; a cluster has 4 observation hours; one hour at each site.

2. The clusters were sampled at rates that spread sampling effort to each of the lake classes, so results can be reported for each class; when classes are combined, results were use-weighted. The breakdown of 1996 boating use by lake class is: Minnetonka—30%, St. Croix—18%, Cat 1—11%, Cat 2—15%, Cat 3—26%.

Cluster sampling rates							
	Percent of		*--------- Number of observation sites by lake class ---------*				
Cluster	sampling effort		Minnetonka	St. Croix	Cat 1	Cat 2	Cat 3
M	19%		4				
S	19%			4			
C1	4%						4
C2	8%				1	2	1
C3	12%				2		2
C4	8%					4	
C5	8%					4	
C6	12%				2		2
C7	12%				2		2
Total percent	100%						

Table A-1: Cluster Sampling Rates

Allocation of sampling effort				
	---------- Distribution of observation hours ----------			
			Obtained on	Obtained on
Lake class	Ideal		weekends/holidays	Weekdays
Minnetonka	20%		18%	19%
St. Croix	20%		18%	19%
Cat 1	20%		19%	20%
Cat 2	20%		19%	16%
Cat 3	20%		25%	26%
Total percent	100%		100%	100%

Table A-2: Allocation of Sampling Effort

3. There were two workday schedules, one for early hours and one for later hours; the start and stop times define the observational hour:

Time period	Start	Stop
early	7:30	8:30
early	9:00	10:00
early	10:30	11:30
early	12:00	13:00
late	14:00	15:00
late	15:30	16:30
late	17:00	18:00
late	18:30	19:30

Table A-3: Workday Schedules

4. The following procedures were used to generate the field sampling plan, which extends from May 19 to September 16 (see results on pages 5 to 8):

Weekends/holidays	
Step	Description
1	Select 2 weekend/holidays each week; if 3 weekend/holidays in a week, select two at random.
2	Assign two work periods to each selected day (two clusters are done each selected day)
3	Select early/late work-day schedule for each period without replacement; each period done independently
4	Assign clusters based on sampling rates for each cluster
5	If same cluster selected for both periods in one day, assign next cluster in random listing used in step 4
Weekdays	
Step	Description
1	Select 4 weekdays each week without replacement
2	Select early or late work-day schedule for each period without replacement
3	Assign clusters based on sampling rates for each cluster

Table A-4: Procedures

5. Scheduled days were shifted among calendar dates as long as the shift did not affect sampling effort statistics, which are the day of week (weekend/holiday, weekday), time of day (early, late), cluster, and quarter of study period being sampled (mid May to mid June, mid June to mid July, mid July to mid August, and mid August to mid September). Also, did not overly load up a particular day of the week (say, load up Fridays, or Sundays).

Lake clusters for PFD observational study (each cluster is a person-day of work, a cluster has 4 observation hours; one hour at each site)					
Lake Number	Name	Cluster	Lake Class	Lake Acres	Number of observation sites
270133	Minnetonka	M	Minnetonka	14,034	4
St. Croix River	St. Croix River	S	St. Croix River	8,215	4
20026	Linwood	C1	Cat 3-PA	567	1
130041	Green	C1	Cat 3-PA	1,830	1
130053	Comfort	C1	Cat 3-PA	220	1
130012 & 130028	Chisago,S Lindstrom	C1	Cat 3-PA	1,594	1
100009	Minnewashta	C2	Cat 1	763	1
100059	Waconia	C2	Cat 3-PA	3,196	1
270067	Bryant	C2	Cat 2-PA	199	1
270137	Christmas	C2	Cat 2-PA	274	1
190026	Marion	C3	Cat 3-PA	489	1
700120	Thole	C3	Cat 3-PA	131	1
700026 & 700072	L & U Prior	C3	Cat 1	1,146	2
270104	Medicine	C4	Cat 2-PA	924	1
270019	Nokomis	C4	Cat 2-PA	199	1
270031	Calhoun	C4	Cat 2-PA	416	1
270111	Eagle	C4	Cat 2-PA	470	1
620056	Owasso	C5	Cat 2-PA	360	1
620057	Josephine	C5	Cat 2-PA	110	1
620061	Turtle	C5	Cat 2-PA	444	1
620078	Johanna	C5	Cat 2-PA	211	1
820052	Big Marine	C6	Cat 1	1,577	2
820159	Forest	C6	Cat 3-PA	2,206	1
820163	Clear	C6	Cat 3-PA	400	1
20006	Centerville	C7	Cat 3-PA	464	1
820049	Big Carnelian	C7	Cat 3-PA	444	1
820167	White Bear	C7	Cat 1	2,410	2

Table A-5: Lake Clusters

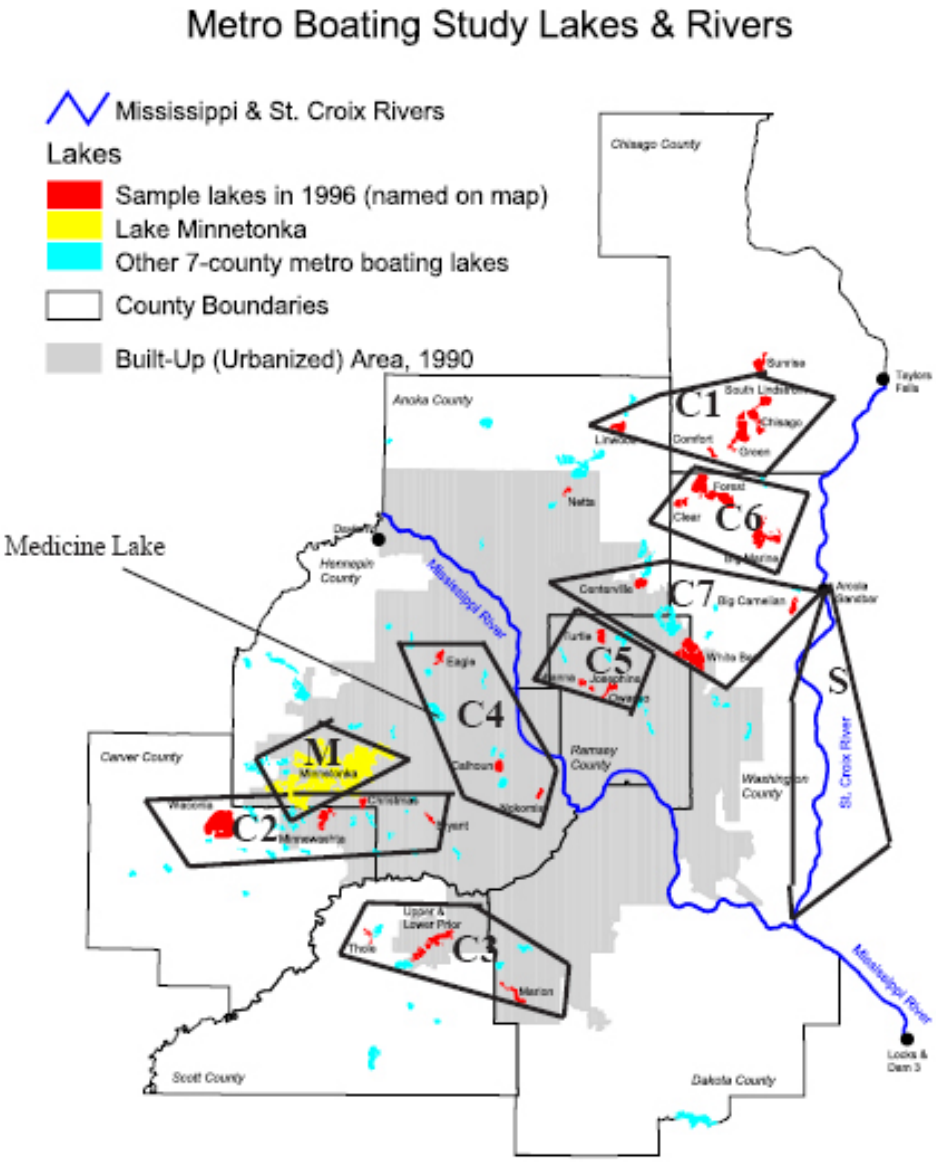


Figure A-1: Lakes & Rivers

Attachment B - Observation Guide

A. Introduction. Thank you for participating in the 2007 Minnesota Department of Natural Resources PFD Wear Rate Study. Many injuries and deaths among recreational boaters could be prevented by consistent use of PFDs. The data we collect in this study will help us to monitor progress in achieving higher levels of recreational boating safety.

As an observer, it will be your job to record pertinent information about craft (such as type of craft, size, etc.) and boaters (gender, age, and whether they are wearing PFDs). This guide will provide you with instructions as to how to choose viewing points, and how to record this information.

B. Personal Flotation Devices. Personal Flotation Device (PFD) is the technical term for life jackets. The DNR's main goal in funding this study is to come up with a wear-rate estimate for PFD use, as well as to look at PFD use on various types of craft, under various weather conditions, and among passengers of different ages and genders.

There are many different kinds of PFDs. Traditionally, they are often bulky and brightly colored (usually orange). However, newer versions of PFDs can be many colors, and may resemble vests more than life jackets. Some of the newest models of PFDs look more like suspenders – these contain small cylinders of carbon dioxide which inflate either manually by tugging on a strap, or automatically when they are exposed to the water.

There are many different kinds of devices that persons may use for flotation, but the DNR is only interested in use of PFDs. Therefore, you should not count persons holding tubes, rafts, or other throwable devices; these are **NOT PFDs**. You should also not count children's devices designed for use in pools (like the inflatable rings they wear on their arms).

C. Scheduling. See Attachment A (Sampling Plan)

D. Weather Cancellations. We want to observe boaters' use of PFDs under a variety of different weather conditions. This means that observations should not be rescheduled unless there is fairly severe weather predicted. If there is a passing shower, return to your car and wait it out, then continue observations and stay later to make up for lost time if possible. If you hear that severe weather is expected at your site, contact the office (651 260-0116) to determine whether you should travel to the observation sites. As a rule of thumb, the only weather cancellation is if lightning is present; if so, please seek shelter, call the office, and register this phenomenon. Proceed to the next observation site and continue the data collection effort.

E. Preparation. Read this entire guide in advance of your observation date. If you have **any** questions, make sure that you get answers **prior** to beginning your first observation. You will need to bring to the observation site a number of items to help you complete the observations and to keep you comfortable during the day. Here is a checklist of what to bring:

Essential items supplied to you by TEC:

- Binoculars (for observation)
- Wind gauge (to determine wind speed)
- Compass (to determine wind direction)
- Thermometers (to determine air and water temperature)
- Clipboard
- Pencils
- Boat Observation forms (100 for each site)
- Site forms (1 for each site)
- This Observation Guide

You may also want to bring:

- Appropriate clothing to protect you from sun, rain, etc.
- Folding chairs to sit on during the observation
- Sunscreen, hats, sunglasses
- Bug/mosquito repellent
- Plenty of water/beverages and lunch/snacks

F. Observation Site. The observation sites have been designated in the Sampling Plan (Attachment A).

G. Observations. The following guidelines are presented for assisting in the determination of which craft or boats are recorded.

How many craft will you observe?

- While we would like you to observe as many boats as possible during the four hours of observation each day at each site, **remember that it is better to observe fewer craft accurately than many craft inaccurately.**

- **Do not count the same boat twice during the same observation period.** This is especially important in areas where boats may be going back and forth several times.

Which boats should you observe? This study is a study of PFD among recreational boaters only. Therefore, you should **NOT** record observations of commercial fishing boats, professionally chartered boats, water shuttles, guided

rafting or canoeing parties, or ferries. You **SHOULD** include people on personal watercraft (PWCs which are commonly known as jet-skis or wave-runners), sailboards (windsurfers), kayaks, rafts, and canoes in addition to the standard powerboats and sailboats that are obvious inclusions.

If a recreational boat is too far away for you to tell whether or not the boaters are wearing PFDs through your binoculars, then **DO NOT** include that boat in your observations. If you **CAN** determine the boaters' PFD use at a minimum (even if gender, for example, is difficult to ascertain), then you **SHOULD** include that boat in your observations and record age and gender as unknown. At a given time, there may be multiple boats passing by and you will need to choose which boat to observe first. **In order to avoid bias in which boats you select, you should choose a landmark at your site and observe the craft that is closest to that landmark at the time you are beginning the next observation.** This will keep you from inadvertently choosing a disproportionate number of boats whose passengers are using PFDs.

H. Examples of Craft that do not get recorded. See the two figures below.

Figure B-1: Not Recorded

Figure B-2: Not recorded

I. Site and Boat Forms. A copy of a site form and a boat form are provided in your folder. The Site form and Boat form are also included in Attachment C of the Work Plan (Worksheets).

To record information about the site, you will use a SITE FORM. Each site form is capable of recording the conditions at two sites. Record the site information when you arrive at a new site.

To record information about the craft and boaters, you will use a BOAT FORM. Each BOAT FORM has room to record information about **two** craft. You should fully complete one form before moving on to the next form. You will be supplied with enough sheets to record data on **several** boats per site. Please use the pencils provided to fill in the forms. Mark each area with an "X" as appropriate. If you make a mistake, erase it fully using the eraser provided. Complete all items.

Each BOAT FORM has space to record observations of two boats. Complete both observations on one form before beginning the next one. **When you begin to record information on a new sheet, please fill out the TIME BLOCKS at the top of the page for every form as you do them**. This is the only way we can connect your boating observations to the air temperature and wind speed information that you are recording on the Site Form. Now we will walk you through each piece of information that you will need to record.

J. Site Conditions (Use Site Form). Begin by recording the site information in the appropriate boxes. Record your name, the body of water (lake name), observation point (code or description), type of site (pier, shore, dock, access, etc.), start and end times, plus the date. Next complete the weather and water conditions of the site using the bottom half of the form.

1. Water Temperature. The water temperature only needs to be recorded once at each site. When you arrive, before you leave, or sometime when the traffic is slow; use the thermometer to record the water temperature. Lower the thermometer into the water to approximately one foot depth. If possible tie the

rope or tether cord to a railing or something else so that the thermometer can remain in the water while you record the other environmental conditions. The thermometer should remain in the water for at least one minute.

2. Weather. At each site, you will record the weather. It is VERY important that we have weather observations for each time block that you observe boats.

3. Air Temperature. Use the thermometer to take the air temperature. Make sure that it is dry when you are doing so.

4. Wind Speed. Use the wind gauge to take the wind speed, *in mph*. Record the maximum wind speed that you read over the course of 30 seconds. Round the wind speed reading to the nearest WHOLE number.

5. Water Conditions. Indicate whether the water is calm (very small waves, six inches or less), choppy (with waves 6 inches or greater but now white caps), or white caps.

6. Visibility. Decide if the visibility is good (clear), fair (hazy or somewhat foggy), or poor (very foggy).

7. Sky Conditions. Finally, decide which of the following terms best describes the current weather conditions: sunny, partly cloudy, cloudy, raining, or stormy (e.g. thunderstorms). If you see lightening, find shelter and move to the next site. The very nature of the observation point is that it is an exposed position, therefore ideal for lightening. Thus, collect equipment and seek shelter. Mark the lightening in the comment section and the record the end time accurately.

There is a comment section (the last box in each site form) to record unusual conditions, such as a fishing contest, boat parade, extreme weather, or other extraordinary conditions.

K. Boat and Boater Characteristics (Use Boat Form). The boat form is used for each boat observed. There are two boat forms on each piece of paper.

1. TYPE OF BOAT and POWER TYPE. For each boat you see, first decide BOAT TYPE, whether it is a BOAT or SAILBOAT. If the craft is a BOAT, then choose one of the ten options in the corresponding box to designate the type of boat observed. For examples (drawings and photos) of each boat type, see the picture book, Attachment D, published separately.

1. Utility/fishing: utility and fishing boats have no windshield.
2. Runabout/speedboat: runabouts and/or speedboats have a windshield.
3. Cabin cruiser: cabin cruisers have a superstructure, look for portholes.
4. Houseboat: houseboats are a variation on a cruiser that resembles a floating home.

5. Pontoon: pontoons look like platforms mounted on two or more cylindrical floats (the pontoons of the boat). All pontoon boats have outboard motors.
6. PWC (Personal Watercraft): PWCs are commonly known as jet-skis or wave-runners.
7. Inflatable/raft: inflatable craft should be categorized here. Do not count persons floating on inner tubes as inflatables or *any* craft.
8. Canoe: canoes are open across the top and usually people sit on seats although sometimes they are kneeling and use paddles to move the canoe through the water.
9. Kayak: kayaks are more pointed, lower to the water and usually have just a hole in center where person sits. Sometimes the "hole" is covered with a water protective "skirt". Usually the person is using a two bladed paddle—one at each end—in a continuous motion stroke. For both canoes & kayaks if there is more than 1 person in the boat, the person in the back seat is considered the "Operator" when filling out gender, age, and PFD use.
10. Other: boats that do not fall into one of the previous nine categories will be recorded here, write a comment if necessary.

2. SAILBOAT. If the craft is a SAILBOAT, then choose one of the three options in the corresponding box to designate the type of sailboat:

1. Sailboard: a sailboard (also known as a windsurfer) is a surfboard-like object attached to a sail. The passenger stands on the board and directs the sail with his upper body.
2. Day sailor: a day sailor is a small sailboat without a cabin (though it may have a small cubby cabin for storage) that is used for day cruising.
3. Cabin sailboat: a larger sailboat with a cabin that persons can enter is a cabin sailboat. Look for port holes.

3. POWER TYPE. After BOAT TYPE has been determined then you determine the POWER TYPE. POWER TYPE refers to the power *capacity* of the boat, and not to the actual *use* of power at the time you are observing. For example, a sailboat that is moving by sail - but which also has a motor - should be classified with the POWER TYPE: *Sail and motor*, even though the motor may not be in use at the time of observation.

4. BOAT. If you have chosen BOAT as the BOAT TYPE, then decide if the POWER TYPE is:

1. **Outboard**: outboard engines/motors are engines that are attached to the back of a boat. The engine is visible off the back, except for the propeller, which reaches into the water. Some sportier boats may have twin outboard motors.

2. **Inboard/sterndrive:** inboard and sterndrive engines/motors are built into the body of a craft, and almost always driven using a steering wheel. The engine is not visible.
3. **Paddles/oars:** most canoes/kayaks and some rowboats/dinghies may be powered using paddles/oars.
4. **Airfan:** these are the swamp boats with a big air fan behind the driver used for power. They are usually very flat.

5. SAILBOAT. If you have chosen SAILBOAT as the BOAT TYPE, then decide if the POWER TYPE is:

1. **Sail only:** Smaller sailboats will tend to have sails with no power back-up (i.e. a motor).
2. **Sail and motor:** Many sailboats will have a motor in addition to sails.

L. SIZE. Next you will record the size (in feet) of the craft as: a) "under 16 feet"; b) "16 to 20 feet"; c); or d) "over 20 feet". There are certain kinds of craft that generally fall into one of these categories. However, the best way to judge the size of craft is through practice. If a boat appears to be on the borderline between two size categories, use your best judgment in choosing one. Boats are generally longer than they seem when in the water and when far away: "under 16 feet" is small—jet skis, rowboats, inflatables, smallish canoes, white water kayaks and very smallish fishing boats. Two person canoes & kayaks are almost always larger than 16 feet. Cabin cruisers and Cabin Sailboats are mostly less than 25 feet but can be over. You need to develop a sense of these boundary size points. At the beginning of your observations, ask a few boaters who pass nearby what the length of their boat is to get you into the groove. Sometimes the length of the boat will be inscribed on the bow (front) or near the back of the boat along with the name of the make/model. For example, you may see inscribed, "Crestliner 16.2" or "Lund 18.4", which would mean the lengths are 16.2 feet and 18.4 feet, respectively. You many even see something similar to this, "Lund 206", which means the length is 20.6 feet. If you can locate this on the boat, please use this to classify the size of the boat.

M. MOVEMENT. The category, MOVEMENT, refers to the motion of the craft you are observing. This is in contrast to the POWER TYPE, which refers to the power capability of the vessel. Boats which are cruising along may be MOTORING if they are using only a motor to cruise, or SAILING if using a sail. Some sailboats may be using both a motor and sail simultaneously to maximize speed. This is often the case, but is it difficult to tell if a sailboat is using its engine in addition to its sail. If you see a sailboat with its sail up, then choose SAILING regardless of whether it may also be using its engine. The remaining categories: TROLLING is used when the boat is moving slowly using the motor and occupants are fishing (lines in the water). ROWING/PADDLING, DRIFTING, and ANCHORED/MOORED are self-explanatory. If a boat is

ANCHORED/MOORED near you, make sure to observe it only once during the course of the observation.

N. ACTIVITY. ACTIVITY refers to a particular activity the craft may be involved in during the time of the observation.

1. **FISHING** means some of the people in the boat are actually fishing while you observe them. Be careful though, they could have lines in the water while they are slowly moving—e.g. trolling. This counts as fishing. If they have poles in the boat and look like they are going fishing this does not count as fishing (poles need to be in the water to count).
2. **SKIING/TUBING** means a boat is pulling a water-skier or tuber (or banana) while you observe them. If the boat has a tube in boat, not the water, then you do not label them WATERSKIING. (See later explanation about designating who is the water-skier or tuber). Some boats may be pulling multiple people, a tube with multiple people in it, or multiple tubes.
3. **CRUISING.** Cruising is a catch-all category that is used when people are just going along in their boats.
4. **SWIMMING** (or diving) off the boat is reserved for situations when the boat is drifting or anchored and people are swimming around the boat and maybe even diving off the boat into the water.
5. **OTHER.** The category OTHER is reserved for specific activities that have not been mentioned above, that would be unusual—hunting from a boat, or being on the boat doing maintenance, or sunbathing on the boat (with no indication of swimming being involved).

O. BOATERS. The boaters' characteristics; AGE, GENDER, and use of PFDs, are the most crucial parts of this study.

P. Operator vs. Passenger. We are interested in finding out whether the Operator's PFD use differs from that of other passengers. It is a good idea to record the characteristics of the Operator first (in the row labeled "OP" – listed first on the form), and them move on to the passengers (in the rows labeled "P").

For each craft, there is room to fill out information on up to ten boaters (one operator and nine passengers). If there is no operator (if, for example, a boat is anchored), then skip the Operator row and fill in all occupants as passengers. If there are more than ten passengers, then fill in information about the passengers wearing life jackets first. Then fill in information about the remaining passengers up to a total of ten. Remember that for *canoes and kayaks* with more than one person in them the person in the *back* is considered the operator.

Q. Gender. Determine the gender of each passenger and mark under M (male), F (female), or "?" if you are unsure. The "?" category is used when you can't tell gender—mostly for very young children or where people are far away or when

they are wearing jackets and hats. Generally speaking, use your best judgment to make a good guess as to the individual's gender.

R. Age. Passengers should be classified into five different age categories (0-5 years, 6-12 years, 13-17 years, 18-64 years, and 65+ years). There will be judgment calls here at the boundaries of the age categories. Try to develop a sense of what the differences are between a 5 or 6 year old and a 12 versus 13 year old are. Some potential indicators may be height and weight. If you are unsure of a passenger's age but believe he/she is 18 or older, then mark the category 18-64 as a default.

S. PFD Use. Last but most important is **PFD** use. Enter yes if you are certain that a PFD is being used by the operator/passenger. Enter no if you are certain that a PFD is not being used by the operator/passenger. Otherwise (if uncertain) enter "??". Do not count other flotation devices like rings or rafts, only those we have defined for you at the beginning of this guide.

T. PFD Type. The PFD types are old, new, and inflatable as described and shown below.

1. Old. This type of PFD is shown in the graphic below (Figure B-3). This type is characterized by color (usually orange) and fits around the neck of the wearer and is connected under the arms and legs using canvas straps.

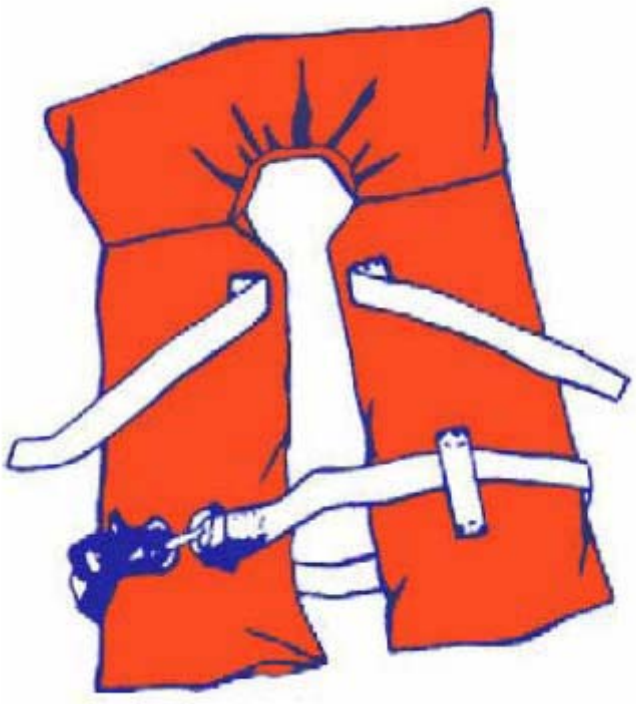


Figure B-3: Old PFD

2. New. This type of PFD is shown in the graphic below (Figure B-4). It is characterized as being a vest with zipper and/or buckles that allow the vest to fit snugly to the body.

Figure B-3: New PFD

3. Inflatable. This type of PFD is shown in the graphic below (Figure B-5). This type has a portion of the PFD that is inflatable by using an air canister or a blow up tube.

Figure B-6: Inflatable PFD

4. Don't Know. It is not possible to tell whether a life jacket is being worn or not.

5. No. The person is not wearing a life jacket of any kind.

U. WS (Waterskier)
This column is used to indicate which person, or persons, are actually being pulled by the boat—either on waterskis or on a tube or a banana. For each of these people indicate by filling in the circle in this column. For people in the boat pulling others, they are not waterskiers—even if they look like they are getting ready to go "next". Since the operator cannot be operating the boat and waterskiing at the same time we have left out the circle for this line. Obviously—only boats whose activity is waterskiing—should have persons marked as waterskiers. Therefore for most boats you are observing this column will be left completely blank.

See the Photo Guide (Attachment D) for additional information and a visual guide for identifying boat types and PFD types.

Attachment C – Worksheets

PFD Wear Rate Study 2007

FIRST SITE
Site Information

Observer:	Lake/Water:
Observation Site:	Type of Site:
Date of Observation:	Day of Week:
Observation Start Time:	Observation End Time:

Site Conditions

Weather	Water Conditions	Visibility	Sky Conditions
Air Temp: _____°F	Calm	Good	Sunny
Water Temp: _____°F (at 1 ft depth)	Choppy	Fair	Partly Cloudy
Wind Speed: ____mph	White Caps	Poor	Cloudy
Comment:			Raining

PFD Wear Rate Study 2007

SECOND SITE
Site Information

Observer:	Lake/Water:
Observation Site:	Type of Site:
Date of Observation:	Day of Week:
Observation Start Time:	Observation End Time:

Site Conditions

Weather	Water Conditions	Visibility	Sky Conditions
Air Temp: _____°F	Calm	Good	Sunny
Water Temp: _____°F (at 1 ft depth)	Choppy	Fair	Partly Cloudy
Wind Speed: ____mph	White Caps	Poor	Cloudy
Comment:			Raining

TIME: DATE: LAKE: OBSERVATION SITE:

BOAT				SAILBOAT	GENDER				AGE(years)					PFD					WS
utility/fishing	houseboat	inflatable/raft	kayak	sailboard		M	F	??	0 5	6 12	13 17	18 64	65 +	old	new	inf	??	no	
runabout/spdboat	pontoon	canoe	other	day sailor	OP														yes
cabin cruiser	PWC			cabin sailboat	P1														
POWER TYPE			POWER TYPE		P2														
outboard		paddles/oars		sail only	P3														
inboard/stern-drive		air fan		sail & motor	P4														
SIZE	MOVEMENT		ACTIVITY		P5														
under 16 feet	cruising	drifting	fishing	swimming	P6														
16-20 feet	sailing	anchored	skiing/tubing	cruising	P7														
over 20 feet	row/paddling	trolling		other	P8														
COMMENT					P9														

TIME: DATE: LAKE: OBSERVATION SITE:

BOAT				SAILBOAT	GENDER				AGE(years)					PFD					WS
utility/fishing	houseboat	inflatable/raft	kayak	sailboard		M	F	??	0 5	6 12	13 17	18 64	65 +	old	new	inf	??	no	
runabout/spdboat	pontoon	canoe	other	day sailor	OP														yes
cabin cruiser	PWC			cabin sailboat	P1														
POWER TYPE			POWER TYPE		P2														
outboard		paddles/oars		sail only	P3														
inboard/stern-drive		air fan		sail & motor	P4														
SIZE	MOVEMENT		ACTIVITY		P5														
under 16 feet	cruising	drifting	fishing	swimming	P6														

16-20 feet	sailing	anchored	skiing/tubing	cruising	P7														
over 20 feet	row/paddling	trolling		other	P8														
COMMENT					P9														

Site Form Legend & Key for Recording Data			
Lake:	270133	Minnetonka	
	St. Croix River	St. Croix River	
	20026	Linwood	
	130041	Green	
	130053	Comfort	
	130012 & 130028	Chisago,S Lindstrom	
	100009	Minnewashta	
	100059	Waconia	
	270067	Bryant	
	270137	Christmas	
	190026	Marion	
	700120	Thole	
	700026 & 700072	L & U Prior	
	270104	Medicine	
	270019	Nokomis	
	270031	Calhoun	
	270111	Eagle	
	620056	Owasso	
	620057	Josephine	
	620061	Turtle	
	620078	Johanna	
	820052	Big Marine	
	820159	Forest	
	820163	Clear	
	20006	Centerville	
	820049	Big Carnelian	
	820167	White Bear	
Site:	GWB	Minnetonka	Causeway shorefish site between Grays and Wayzata

Site Form Legend & Key for Recording Data			
			Bay;
	H50	Minnetonka	3 platform sites: H50, H51 and H53
	H51	Minnetonka	
	H53	Minnetonka	
	W22	St. Croix River	W22-access, W25-bankfish, W27-access, W24-platform
	W25	St. Croix River	
	W27	St. Croix River	
	W24	St. Croix River	
	A15	Linwood	A15-platform
	SA	Green	Access on south side
	NS	Comfort	Access on north side
	NP	Chisago,S Lindstrom	Pier at north end
	C16	Minnewashta	C16-pier
	C29	Waconia	C29-access
	H2	Bryant	H2-pier
	H8	Christmas	H8-access
	D17	Marion	D17-pier
	S18	Thole	S18-access
	S13	L & U Prior	S13-pier, S14-access
	S14		
	H33	Medicine	H33-pier
	H63	Nokomis	H63-pier
	H5	Calhoun	H5-pier
	H15	Eagle	H15-pier
	R21	Owasso	R21-access
	R10	Josephine	R10-access
	R29	Turtle	R29-access
	R9	Johanna	R9-pier
	W4	Big Marine	W4-access, W5-access
	W5	Big Marine	
	W12	Forest	W12-access
	W8	Clear	W8-access
	A2	Centerville	A2-access
	W3	Big Carnelian	W3-access
	R32	White Bear	R32-access, R34-pier

Site Form Legend & Key for Recording Data			
	R34	White Bear	
Site type:	1	Access	
	2	Causeway	
	3	Pier	
	4	Platform	
	5	Other	
Date:	m/dd		
Day:	1	Sunday	
	2	Monday	
	3	Tuesday	
	4	Wednesday	
	5	Thursday	
	6	Friday	
	7	Saturday	
Time:	military		
Temp/Speed:	number		
Water conditions:	1	Calm	
	2	Choppy	
	3	White caps	
Visibility:	1	Good	
	2	Fair	
	3	Poor	
Sky Conditions:	1	Sunny	
	2	Partly cloudy	
	3	Cloudy	
	4	Raining	

Boat Form Legend & Key for Recording Data			
Time:	military		
Date:	m/dd		
Lake:	270133	Minnetonka	
	St. Croix River	St. Croix River	
	20026	Linwood	
	130041	Green	
	130053	Comfort	
	130012 & 130028	Chisago,S Lindstrom	
	100009	Minnewashta	
	100059	Waconia	
	270067	Bryant	
	270137	Christmas	
	190026	Marion	
	700120	Thole	
	700026 & 700072	L & U Prior	
	270104	Medicine	
	270019	Nokomis	
	270031	Calhoun	
	270111	Eagle	
	620056	Owasso	
	620057	Josephine	
	620061	Turtle	
	620078	Johanna	
	820052	Big Marine	
	820159	Forest	
	820163	Clear	
	20006	Centerville	
	820049	Big Carnelian	
	820167	White Bear	
Site:	GWB	Minnetonka	Causeway shorefish site between Grays and Wayzata Bay;
	H50	Minnetonka	3 platform sites: H50, H51 and H53
	H51	Minnetonka	
	H53	Minnetonka	
	W22	St. Croix River	W22-access, W25-bankfish, W27-access, W24-platform
	W25	St. Croix River	
	W27	St. Croix River	
	W24	St. Croix River	
	A15	Linwood	A15-platform
	SA	Green	Access on south side
	NS	Comfort	Access on north side
	NP	Chisago,S Lindstrom	Pier at north end
	C16	Minnewashta	C16-pier
	C29	Waconia	C29-access
	H2	Bryant	H2-pier

Boat Form Legend & Key for Recording Data			
	H8	Christmas	H8-access
	D17	Marion	D17-pier
	S18	Thole	S18-access
	S13	L & U Prior	S13-pier, S14-access
	S14		
	H33	Medicine	H33-pier
	H63	Nokomis	H63-pier
	H5	Calhoun	H5-pier
	H15	Eagle	H15-pier
	R21	Owasso	R21-access
	R10	Josephine	R10-access
	R29	Turtle	R29-access
	R9	Johanna	R9-pier
	W4	Big Marine	W4-access, W5-access
	W5	Big Marine	
	W12	Forest	W12-access
	W8	Clear	W8-access
	A2	Centerville	A2-access
	W3	Big Carnelian	W3-access
	R32	White Bear	R32-access, R34-pier
	R34	White Bear	
Boat:	1	Utility/fishing	
	2	Runabout/spdboat	
	3	Cabin cruiser	
	4	Houseboat	
	5	Pontoon	
	6	PWC	
	7	Inflatable/raft	
	8	Canoe	
	9	Kayak	
	10	Other	
	11	Sailboat	
	12	Day sailor	
	13	Cabin sailboat	
Powertype:	1	Outboard	
	2	Inboard/stern-drive	
	3	Paddles/oars	
	4	Air fan	
	5	Sail only	
	6	Sail & motor	
Size:	1	under 16 feet	
	2	16-20 feet	
	3	over 20 feet	

Boat Form Legend & Key for Recording Data			
Movement:	1	Cruising	
	2	Sailing	
	3	Row-paddling	
	4	Drifting	
	5	Anchored	
	6	Trolling	
Activity:	1	Fishing	
	2	Skiing/tubing	
	3	Swimming	
	4	Cruising	
	5	Other	
Gender	1	Male	
	2	Female	
	3	??	
Age	1	0-5 years	
	2	6-12 years	
	3	13-17 years	
	4	18-64 years	
	5	65+ years	
PFD	1	old	
	2	new	
	3	inflatable	
	4	??	
	5	no	
WS	1	yes	

Attachment D – Photo Guide for Type Recognition