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FISHERY INVENTORY AND BASELINE WATER QUALITY NAB LITTLE CREEK VA
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U S FISH AND WILDLIFE SERVICES

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FISHERY INVENTORY AND BASELINE WATER QUALITY
COLLECTED AT LITTLE CREEK NAVAL AMPHIBIOUS BASE, VIRGINIA

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ABSTRACT

Baseline information concerning the quality, size distribution and abundance of fishes and water quality parameters at the Little Creek Naval Amphibious Base (NAB), Virginia was collected in May and October 1992. Data analyzed from collections obtained at Lake Bradford indicated that the base has a reasonably healthy and diverse sportfish population. No threatened or endangered fish species were collected. Water quality parameters were within acceptable boundaries for good fish health, growth and reproduction, however, pH values were sometimes high.



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INTRODUCTION

Surveys of the fishery resource inhabiting Lake Bradford, located within the boundaries of the NAB, are necessary for effective and meaningful management strategies. As such, the NAB requested that the Service conduct fishery surveys and water quality analyses of the primary fishing impoundment on base. Data collected are valuable to NAB for development of a management plan for this resource.



STUDY AREA

Lake Bradford is approximately 134 surface acres in size. Maximum/average depths have not been measured. The lake is irregularly shaped with numerous coves. The west side of the lake is adjacent to base housing and the shoreline receives heavy foot traffic. The east shore is privately owned. Submerged cover in the form of downed trees along the shore provides excellent fish habitat. The coves have an abundance of spatterdock (*Nuphar luteum*) that also provides good fish habitat.



MATERIALS AND METHODS

Lake Bradford was sampled with a gasoline powered electro-fishing shocker boat. Fishes were collected by dipnet, identified to species, measured, weighed and released.

A Hydrolab Surveyor III water quality meter was used to collect data at selected stations in Lake Bradford for water temperature, pH, Oxidation-Reduction Potential, dissolved oxygen (DO), percent oxygen saturation, conductivity and salinity.

Electro-fishing occurred at 1-h intervals which was considered sufficient for a representative fish sample. Fishes were obtained along shorelines or at known, fish aggregating locations (i.e., points and bridges).



DATA ANALYSIS

Collections of fishes were summarized by total number (n), average length and average weight based on the size criteria of Proportional Stock Density (PSD) (Kohler and Hubert 1993) (see Appendix A). The categories of PSD are based on percentages of world record lengths and take into account the interaction of reproduction, growth and mortality. Fishes of "Quality" size or larger, are considered to be the size that most anglers like to catch, while "Stock" size is the size at or near sexual maturity. Fishes less than the minimum size for "Stock" density are considered juveniles and are represented as "Other" in Tables 2 and 3 of this report. Some species (i.e., Warmouth and Brown Bullhead) do not have size designations developed for them and only occur in the general species composition list (Table 1). Abbreviations for all fishes collected at NAB are defined in Appendix B.

Relative weight (W_{rel}) is a common measure of fish health/quality that may be calculated using a simple logarithmic equation generated from linear regression. Fish length and weight are the only required variables. Values of W_{rel} permit comparisons with fishes from other populations (all over the country). While these equations have been developed for a number of species, largemouth bass and bluegill are the only fishes that occur in base waters that have equations developed for them. Fortunately, these species are two of the most common in base waters. Fish with W_{rel} near 100 are considered to be in balance with their food supply. Fish with values below 85 are underweight, indicating that they may be too abundant for their food supply. Fish with values exceeding 105 are more well fed than necessary, reflecting an over-abundant food supply. Consequently, when W_{rel} are high (> 105) the impoundment does not meet its' carrying capacity and could support more fish without detrimental effects. However, for a trophy bass fishery, values



exceeding 100 may be preferred. Relative weights were calculated on all largemouth bass and bluegill collected to compare fish of each size class both within and among each sampling location.



RESULTS

Fish Community Structure - Samples taken during May 1992 resulted in the collection or observation of 14 species of fishes (Table 1). Overall species diversity was not surprising. Since small, minnow-type fishes were not as vulnerable to the electro-shocker, all species of forage fishes may not have been collected. Gizzard shad, tidewater silverside and golden shiner appear to be the predominant, non-game forage present. Largemouth bass, bluegill, white perch, pumpkinseed sunfish and black crappie were the numerically dominant gamefishes.

Samples collected during October 1992 contained fewer species ($n = 8$) and fewer total individuals. Only black crappie and white perch were collected in greater abundance in October. These observation may be partly due to angling pressure but may also be the result of constraints of the electro-fisher in colder water or the movement of fishes to areas not sampled.

Gamefishes collected at Lake Bradford were summarized by total number, average length and weight for each of the Proportional Stock Density (PSD) size classes (Table 2). Overall, gamefish at the NAB fell into 5 categories, "Stock", "Quality", "Preferred", "Memorable" and "Other", with good distribution among the sizes. No "Trophy" fish of any species were collected. Length-Weight relationships for primary gamefishes are presented in Appendix C and are provided for later comparisons as one year of data precludes any comparative measures to be made.

Relative Weights - Differences in the relative weights of LMB between sampling dates at Lake Bradford were observed between the different size classes of fish (Table 3). Small LMB, those designated "Other", "Stock" and "Quality" all had relative weights < 85 in May, a condition indicative of either an inadequate food supply or typically low condition after spawning.



Table 1. Species Composition at Little Creek Amphibious Base

May 1992			Oct. 1992		
<u>Species</u>	<u>Number</u>	<u>Weight</u>	<u>Species</u>	<u>Number</u>	<u>Weight</u>
LMB	125	67.5	LMB	65	46.9
BLG	69	3.2	BLG	41	2.4
WHP	33	1.2	WHP	43	2.8
PSS	30	0.9	PSS	2	0.1
TIS	7	*	TIS	+	*
BLC	7	0.7	BLC	26	4.0
GIS	6	1.5	GIS	5	0.4
BBH	4	1.4	BBH	+	*
GOS	2	0.1	GOS	+	*
WCF	2	2.4	WCF	1	2.1
BOF	1	0.9	BOF	+	*
CHP	1	0.3	CHP	+	*
CRP	1	0.9	CRP	-	*
WAR	1	0.1	WAR	1	0.1



Table 2. Proportional stock density for fishes collected at Little Creek Amphibious Base.

A. May 1992

Species	Stock			Quality			Preferred			Memorable			Trophy			Other		
	n	length	weight	n	length	weight	n	length	weight	n	length	weight	n	length	weight	n	length	weight
LMB	52	258	195	41	336	477	20	428	1120	5	550	3000	0	0	0	7	168	54
BLG	33	118	32	24	167	89	0	0	0	0	0	0	0	0	0	12	66	3
WHP	26	146	39	1	202	95	0	0	0	0	0	0	0	0	0	0	0	0
PSS	28	108	26	2	165	93	0	0	0	0	0	0	0	0	0	0	0	0
BLC	3	193	73	3	214	105	1	261	210	0	0	0	0	0	0	0	0	0

B. October 1992

Species	Stock			Quality			Preferred			Memorable			Trophy			Other		
	n	length	weight	n	length	weight	n	length	weight	n	length	weight	n	length	weight	n	length	weight
LMB	13	268	244	29	337	507	20	428	1221	2	526	2325	0	0	0	1	77	5
BLG	21	122	33	19	166	88	0	0	0	0	0	0	0	0	0	1	72	6
WHP	21	151	47	6	213	130	3	255	250	0	0	0	0	0	0	13	125	23
PSS	2	140	63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BLC	2	171	60	18	225	147	5	260	245	0	0	0	0	0	0	1	102	12



Table 3. Relative weights for Largemouth Bass (LMB) and Bluegill (BLG) with electrofishing gear at Little Creek Amphibious Base.

Date	Species	Relative Weight					
		Stock	Quality	Preferred	Memorable	Trophy	Other
May 1992	LMB	79	83	90	111	-	83
	BLG	90	89	-	-	-	71
October 1992	LMB	87	88	97	98	-	100
	BLG	92	91	-	-	-	100



Larger LMB ("Preferred" and "Memorable") were in good balance with their food supply during both sample periods. All size classes of LMB collected in October, were found to be in good balance with their food supply.

The condition of BLG during both sampling periods remained relatively consistent. All BLG were in good condition with only the smallest ("Other") BLG in May being below 85.

Water Quality - Measurements of water quality parameters (Appendix D) during the 1992 sampling period indicated that conditions were favorable for the growth and reproduction of the fishes present at NAB.

Dissolved Oxygen (DO) values at the surface, were 10.1-11.41 ppm and declined only slightly (8.42-11.3 ppm) at the bottom, indicating that the shallow lake was well mixed. Under normal conditions, 3.0 ppm of dissolved oxygen, or less, should be regarded as hazardous or lethal to fish. Dissolved oxygen from 6.0 to 9.0 ppm is more ideal for the fish communities present and these conditions were exceeded in Lake Bradford. The pH values of most inland waters containing fish range between 6.7 and 8.6 and most fishes do well under a wide pH range (4.7-8.7). Values of pH at Lake Bradford generally fell within this range. However, some sampling dates and locations did reveal values slightly above the preferred range. Values of salinity and conductivity, as expected, were at or near zero at all sample locations and depths.



DISCUSSION

Largemouth Bass (LMB) - Few young-of-the-year LMB ("Other") were collected during the survey. Consequently, while Lake Bradford may support a reproductively active LMB population, success may be limited. While no "Trophy" LMB were observed, it is possible that these size classes do occur in base waters. The distribution of sizes among the two sample dates were similar and differences were probably due to growth over the summer months and removal of larger fishes by angling or predation. Low W_{rel} during May was probably a function of post-spawning condition since LMB collected in October, when fish had recovered from the energy expended during spawning, were in very good condition.

Bluegill (BLG) - The bluegill population in Lake Bradford was comprised of small fish in good condition. Failure to collect large bluegill may be the result of: 1) overfishing; 2) competition with other, more aggressive species or; 3) sampling error. Regardless, these fish provide important forage to LMB in Lake Bradford.

Other Gamefish (BBH, CHP, BLC, WHP and PSS).- All other gamefishes were relatively common but size distributions indicate that their contribution to the overall, recreational fishery is minimal, with the exception of BLC. Other species (i.e. CHP and WAR) were only represented by one or two species and would probably be considered unusual occurrences in a creel census.

Forage Fish (GOS, GIS, TIS).- Forage fish species were abundant in Lake Bradford and probably contribute greatly to the overall, good condition of LMB. Unfortunately, however, abundant forage may explain the apparent difficulty in angling for LMB in Lake Bradford.



Water Quality - Water quality at Lake Bradford was suitable for fish growth and health, however, pH values were near the preferred maximum and exceeded the maximum at some stations. No oxygen minima (values < 3.0 p.p.m.) were measured during the survey.



RECOMMENDATIONS

The results from the 1992 surveys showed a marked improvement in the fish community over the collections made July 31, 1986. There is no explanation why the fisheries have improved, as no major changes in management practices have been implemented nor have changes been made in fishing regulations. It appears that natural changes may have been responsible for the improvement.

To assist NAB in monitoring the fisheries in Lake Bradford, it is recommended that fish surveys be conducted annually. Quarterly monitoring of water quality is recommended to determine the magnitude of fluctuation in pH that could potentially affect successful fish reproduction.



Appendix A. Proposed maximum total length (cm) for minimum stock, quality, preferred, memorable, and trophy sizes based on percentages of world record lengths.

	Size Designation				
	Stock	Quality	Preferred	Memorable	Trophy
Largemouth bass	20	30	38	51	63
Bluegill	8	15	20	25	30
Pumpkinseed	8	15	20	25	30
White Perch	13	20	25	30	38
Black crappie	13	20	25	30	38

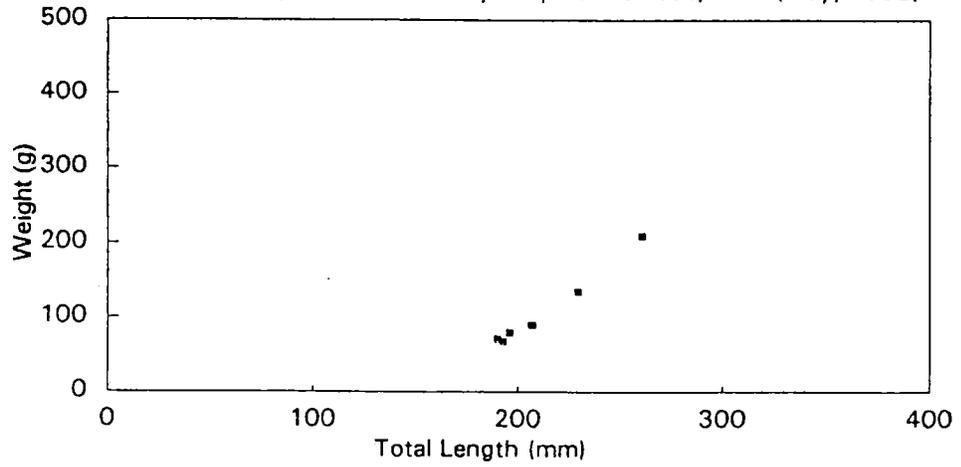


APPENDIX B. Abbreviations for fishes collected within Lake
Bradford, Little Creek Amphibious Base, Norfolk,
VA.

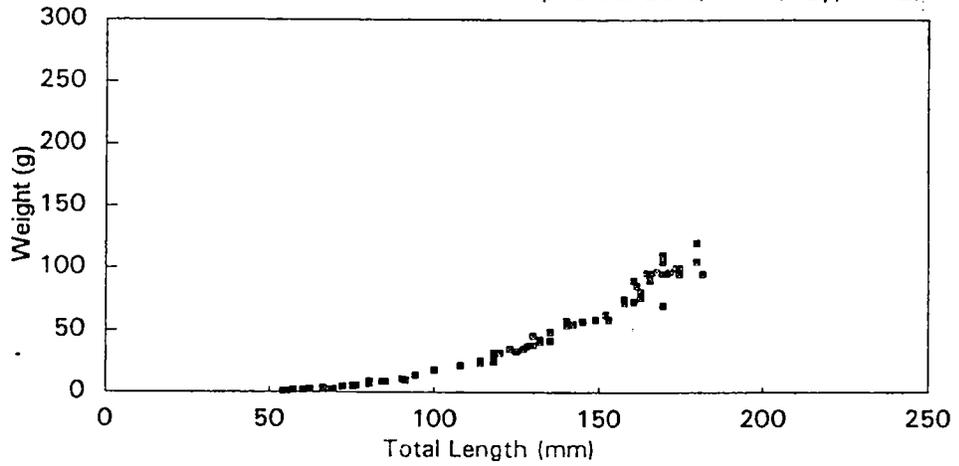
LMB- Largemouth Bass
BLG- Bluegill
WHP- White Perch
BLC- Black Crappie
PSS- Pumpkinseed
BBH- Brown Bullhead
GIS- Gizzard Shad
TIS- Tidewater Silverside
WAR- Warmouth
GOS- Golden Shiner
WCF- White Catfish
BOF- Bowfin
CHP- Chain Pickerel
CRP- Common Carp



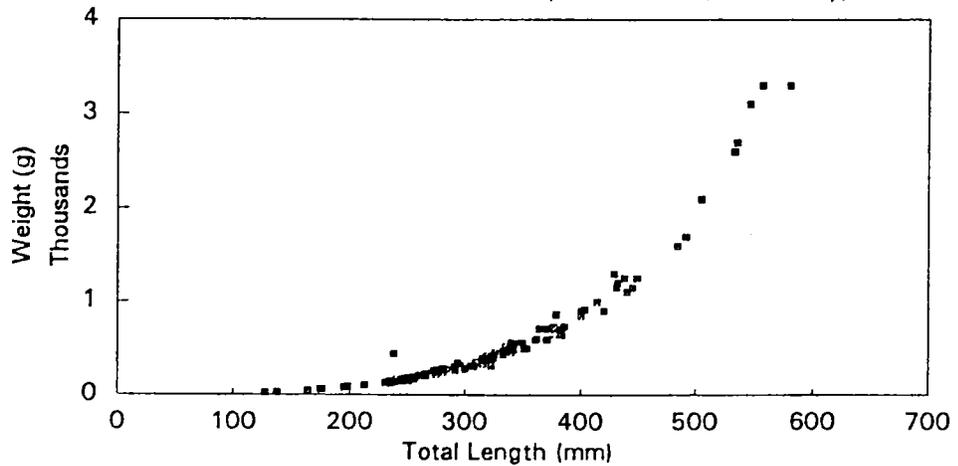
Weight-Length relation for black crappie collected from
Lake Bradford, Little Creek Navy Amphibious Base, VA. (May, 1992)



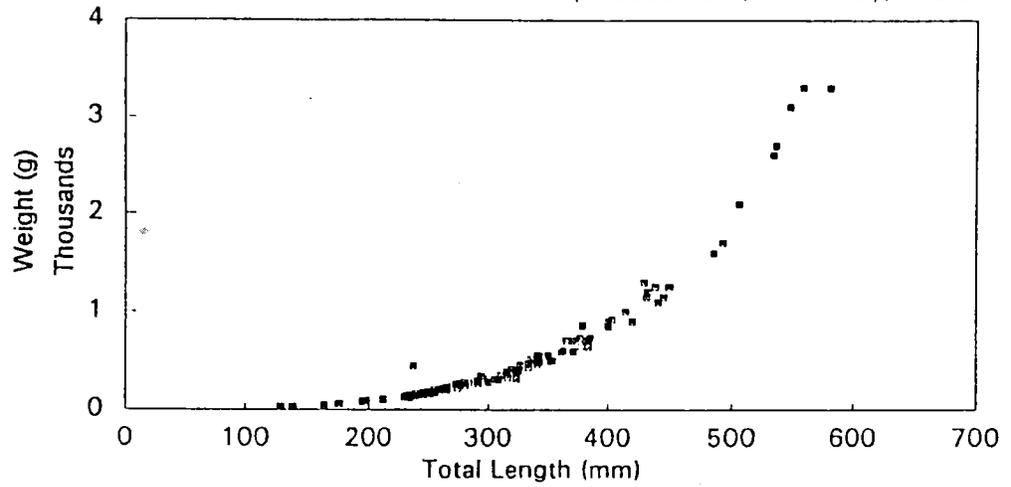
Weight-Length relation for bluegill collected from
Lake Bradford, Little Creek Naval Amphibious Base, VA. (May, 1992)



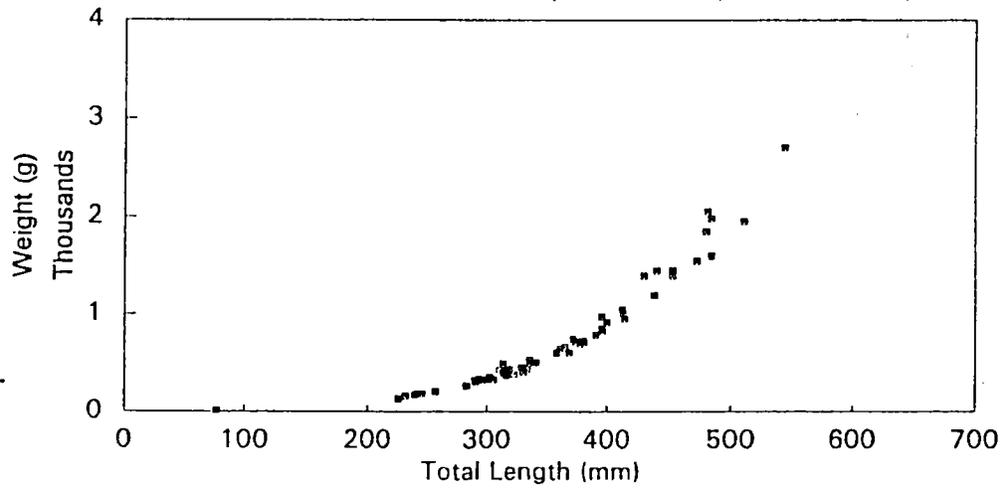
Weight-Length relation for largemouth bass collected from
Lake Bradford, Little Creek Naval Amphibious Base, VA. (May, 1992)



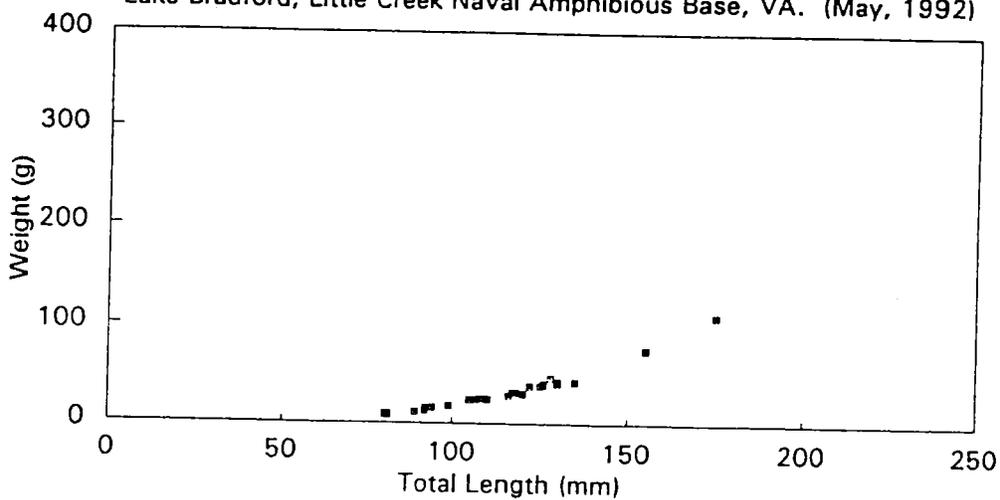
Weight-Length relation for largemouth bass collected from Lake Bradford, Little Creek Naval Amphibious Base, VA. (May, 1992)



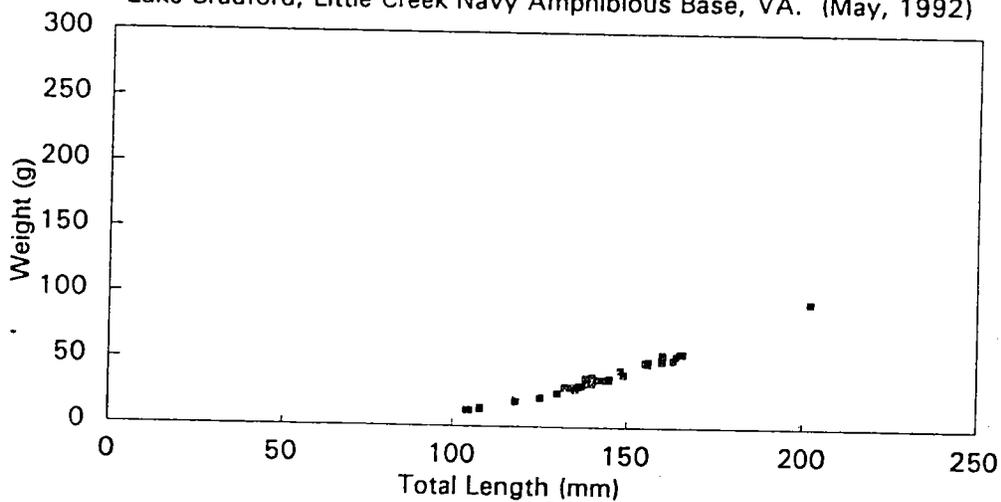
Weight-Length relation for largemouth bass collected from Lake Bradford, Little Creek Naval Amphibious Base, VA. (October, 1992)



Weight-Length relation for pumpkinseed sunfish collected from Lake Bradford, Little Creek Naval Amphibious Base, VA. (May, 1992)



Weight-Length relation for white perch collected from Lake Bradford, Little Creek Navy Amphibious Base, VA. (May, 1992)



Appendix C. Weight-length relationship for selected gamefishes collected, May and October 1992, at Little Creek Naval Amphibious Base.



Appendix D: Water Quality Measurements at the Little
Creek Naval Amphibious Base, May and
October 1992.



LITTLE CREEK NAVAL AMPHIBIOUS BASE WATER QUALITY DATA

STATION: Admiral's Point
 DATE: 05/29/1992
 TIME: 1316

Sample Depth (m)	Water Temp. (C)	pH	DO (ppm)	Cond. (mS/cm)	ORP (v)	Salinity (ppt)
Surface	19.63	8.55	11.41	0.199	0.027	0.0
0.7	19.61	8.89	11.44	0.200	0.030	0.0
1.5	19.42	8.78	11.30	0.199	0.027	0.0

STATION: MOQ D74
 DATE: 05/29/1992
 TIME: 1243

Sample Depth (m)	Water Temp. (C)	pH	DO (ppm)	Cond. (mS/cm)	ORP (v)	Salinity (ppt)
Surface	20.28	8.25	11.15	0.200	0.044	0.0
0.6	18.94	8.39	11.21	0.201	0.020	0.0
1.2	18.71	8.11	10.04	0.201	0.014	0.0

STATION: Osprey Point
 DATE: 05/29/1992
 TIME: 1350

Sample Depth (m)	Water Temp. (C)	pH	DO (ppm)	Cond. (mS/cm)	ORP (v)	Salinity (ppt)
Surface	19.54	8.45	11.07	0.200	0.030	0.0
0.6	19.49	8.71	11.10	0.200	0.022	0.0
1.3	19.27	8.60	10.88	0.199	0.020	0.0

STATION: Scout Island
 DATE: 05/29/1992
 TIME: 1302

Sample Depth (m)	Water Temp. (C)	pH	DO (ppm)	Cond. (mS/cm)	ORP (v)	Salinity (ppt)
Surface	18.82	8.24	11.18	0.199	0.056	0.0
0.4	18.88	8.35	11.41	0.199	0.030	0.0
0.8	18.26	8.25	9.91	0.199	0.066	0.0

KEY:

Cond. = Conductivity
 ORP = Oxygen Reduction Potential
 DO = Dissolved Oxygen
 (C) = Celsius
 (m) = meter(s)
 (mS/cm) = millisiemens per centimeter
 (ppm) = parts per million
 (ppt) = parts per thousand
 (v) = volts



Little Creek Naval Amphibious Base Water Quality Data

STATION: South Arm
 DATE: 05/29/1992
 TIME: 1230

Sample Depth (m)	Water Temp. (C)	pH	DO (ppm)	Cond. (mS/cm)	ORP (v)	Salinity (ppt)
Surface	20.34	7.88	10.13	0.201	0.093	0.0
0.2	20.05	7.45	9.89	0.201	0.061	0.0
0.5	18.69	7.42	8.42	0.202	0.049	0.0

STATION: Osprey Point
 DATE: 10/14/1992
 TIME: 1552

Sample Depth (m)	Water Temp. (C)	pH	DO (ppm)	Cond. (mS/cm)	ORP (v)	Salinity (ppt)
Surface	21.31	9.00	10.11	0.166	0.039	0.0
0.5	21.22	9.02	9.83	0.162	0.041	0.0
1.1	18.99	8.95	9.60	0.161	0.046	0.0

KEY:

- Cond. = Conductivity
- DO = Dissolved Oxygen
- ORP = Oxygen Reduction Potential
- (C) = Celsius
- (m) = meter(s)
- (mS/cm) = millisiemens per centimeter
- (ppm) = parts per million
- (ppt) = parts per thousand
- (v) = volts

