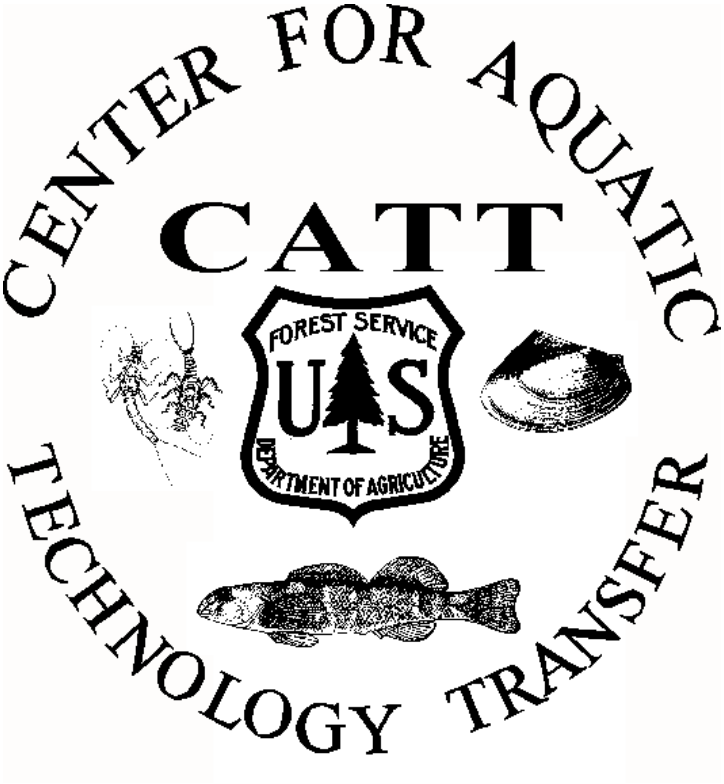
Summary of Stream Habitat and Fish Inventories on the Boston Mountain Ranger District, Ozark National Forest, 2011



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Introduction

The USDA Forest Service, Southern Research Station, Center for Aquatic Technology Transfer (CATT) has worked with resource managers on the Ozark National Forest (ONF) since 2004 to develop and implement customized stream inventories. The CATT field crews have performed stream habitat and fish inventories on the Big Piney (formerly Bayou and Buffalo), Boston Mountain, Magazine, Pleasant Hill, St. Francis, and Sylamore Ranger Districts (Leonard et. al., 2005; Nuckols et. al., 2006; Krause et. al., 2006; 2007; 2008; Fink et. al., 2010). In spring 2011, the ONF requested assistance with stream habitat and fish inventories on the Boston Mountain Ranger District to obtain baseline data for land use management decisions. We deployed a biologist and 3 technicians from June 6 to 29, 2011 to quantify stream habitat conditions and provide associated fish assemblage information.

This report presents aquatic habitat and fish population data collected during June, 2011 in Hurricane Creek and Salt Fork Creek. All of the collected data, as well as detailed reports summarizing the data, are available in the project's MS Access database ('Arkansas Bvet Efish Pebble Database 2005-2011.mdb').

Methods

Habitat Inventory

Two-person crews performed customized basinwide visual estimation technique (BVET) (Dolloff et al. 1993) stream habitat inventories. Stream inventories began at USFS boundaries or at the downstream end of reaches as defined in the National Hydrography Dataset (NHD), which were often the confluence with another NHD reach. A map delineating stream reaches with corresponding reach numbers was provided by the Forest prior to the start of the inventory. At the beginning of the inventory the crew determined the starting NHD number from these maps. Crews tracked their location with GPS and 1:24,000 USGS topographic maps, and recorded changes in NHD numbers as they moved upstream. Surveys were terminated when encountering an upstream USFS boundary or a continuously dry channel for more than 500 m.

We used a two-stage visual estimation technique to quantify stream habitat on the Boston Mountain Ranger District. During the first stage, habitat was stratified into similar groups based on naturally occurring habitat units including pools (areas in the stream with concave bottom profile, gradient equal to zero, greater than average depth, and smooth water surface), and riffles (areas in the stream with convex bottom profile, greater than average gradient, less than average depth, and turbulent water surface). Glides (areas in the stream similar to pools, but with average depth and flat bottom profile) were identified during the survey but were grouped with pools for data analysis. Runs (areas in

the stream similar to riffles but with average depth, less turbulent flow, and flat bottom profile), and cascades (areas of fast water with gradient ≥12%) were grouped with riffles for data analysis.

A two-person crew classified and inventoried stream habitat; one crew member identified each habitat unit by type (as described above), estimated average wetted width, average and maximum depth, riffle crest depth (RCD), substrate composition, and percent fines. The length of each habitat unit was measured with a hip chain (1 m increments). Average wetted width was visually estimated. Average and maximum depth of each habitat unit were estimated by taking depth measurements at various places across the channel profile with a graduated staff marked in 5 cm increments. The RCD was estimated by measuring water depth at the deepest point in the hydraulic control between fast and slow-water habitat units. Substrates were assigned to one of nine size classes (Appendix A, Table A1). Dominant substrate (covered greatest amount of surface area in habitat unit) and subdominant substrate (covered 2nd greatest amount of surface area in habitat unit) were visually estimated. We estimated percent fines, which are the percent surface area of the streambed consisting of sand, silt, or clay substrate particles (particles < 2 mm diameter). In addition, several stream features and their associated attributes (location, type, size, etc.) were recorded when encountered including: bridge, culvert, dam, ford, landslide, seep, side channel, tributary, and waterfall.

The second crew member classified and inventoried large wood (LW) within the stream channel and recorded data with an electronic data logger. Pieces of LW were assigned to one of four size classes (Appendix A, Table A2). Wood less than 1.0 m long and less than 10 cm in diameter was omitted from the survey.

The first unit of each habitat type selected for intensive (second stage) sampling (i.e. measured wetted width) was determined randomly. Additional units were selected systematically (every 10th habitat unit type for streams greater than 1,000 m, and every 5th habitat unit type for streams less than 1,000 m). The wetted width of each systematically selected habitat unit was calculated as the average of at least three transects measured with a meter tape. In each of the systematically selected (second stage) riffles the bankfull stream channel width, riparian width, channel gradient, and water temperature were measured with a meter tape, clinometer, and thermometer. In addition, a digital photograph looking upstream was taken and GPS coordinates were recorded (UTM NAD83). Bankfull channel width was recorded as the width of the bankfull channel perpendicular to flow. Riparian width was measured from the edge of the bankfull channel to the intersection with the nearest landform at an elevation equal to two-times maximum bankfull depth as described by Rosgen (1996). Gradient of the channel was measured with a clinometer by sighting as great a distance as feasible from downstream to upstream between riffles. Water temperature was measured in flowing water out of direct sunlight with a thermometer. The

downstream and upstream ends of every second paired sample unit were flagged to mark fish inventory and pebble count locations.

A calibration ratio was developed using the ratio of measured to estimated area (Dolloff et al. 1993), which allowed correction of visual estimates. BVET calculations and data summaries were computed with a Microsoft Access database.

Fish Inventory

An Appalachian Aquatics backpack electrofishing unit (running direct current) was used to collect fish from every 2nd paired sample-unit flagged during the habitat inventory. In each designated habitat unit a four-person crew performed a single electrofishing pass with 2 dip-nets. We did not set blocknets. The voltage and total shock time (seconds) was recorded from the built-in timer on the backpack electrofishing unit. The total number of young-of-year (age 0+) and/or adult (older than age 0+) of each captured species were recorded and fish were released back into the habitat unit. In cases where species identification was not certain specimens were vouchered. All vouchers were preserved in labeled containers using 70% ethyl alcohol and were later identified by Keith Whalen, ONF Fish Biologist.

Pebble Count

Electrofishing crews also conducted pebble counts to characterize the substrate composition of sample reaches. Pebble counts were performed in riffles designated for electrofishing by walking transects perpendicular to the flow within the bankfull channel (Harrelson et al. 1994). The person walking the transect began at the edge of the bankfull channel on one side of the stream and walked heel-to-toe across the stream channel to the opposite bank (Wolman, 1954). At each step the individual picked up the pebble at the tip of their toe and measured its intermediate axis with a ruler to the nearest millimeter (Bunte and Abt, 2001). For very large particles, the same particle was counted as many times it was encountered. These procedures were repeated until at least 100 measurements were recorded. Transects were not terminated until the opposite bank was reached even if this resulted in more than 100 measurements. Transects were distributed by visually subdividing the riffle. If detritus, wood, or other organic materials were encountered the rock substrate found directly below them was sampled. For data analysis the substrate particle sizes were grouped into size class categories (Appendix, Table A3) and substrate classified as bedrock was placed within the very large boulder category (2048-4096 mm) (G. Kappesser, USDA Forest Service, personal communication).

Results

The CATT and ONF personnel completed 2 inventories on 37 km of streams within 19 National Hydrography Dataset (NHD) stream reaches (Table 1). Field crews recorded a total of 4 km of dry habitat. We collected fish data from 27 pools within 15 NHD reaches and 22 riffles within 12 NHD reaches (Table 2). We collected pebble data from 22 riffles within 12 NHD reaches (Table 2). We captured a total of 19 different fish species (Table 3). The data collected by the CATT can be used to describe stream condition on the ONF and serve as a baseline for future comparisons and land management decisions. Summary tables of habitat characteristics, substrate, large wood, and fish abundance are available through the project database (Appendix B).

Data Availability

The 2005, 2006, 2007, 2008, 2009, 2010, and 2011 stream habitat, fish, and pebble data are stored in a Microsoft Access Database, which is stored at the CATT and an offsite backup (O:\RD\SRS\Site\BlacksburgVA\Admin\CATT Center for Aquatic Technology Transfer\National Forest System\ACCESS Databases), and a copy has been provided to Keith Whalen, ONF Fish Biologist. We will support the migration of this data into the USFS database tool, Natural Resource Information System Aquatic Surveys (NRIS AqS) as needed. We have created custom queries and reports within the database that summarize the data as requested by the ONF (Appendix B). Past reports are available on the CATT website: www.srs.fs.usda.gov/catt.

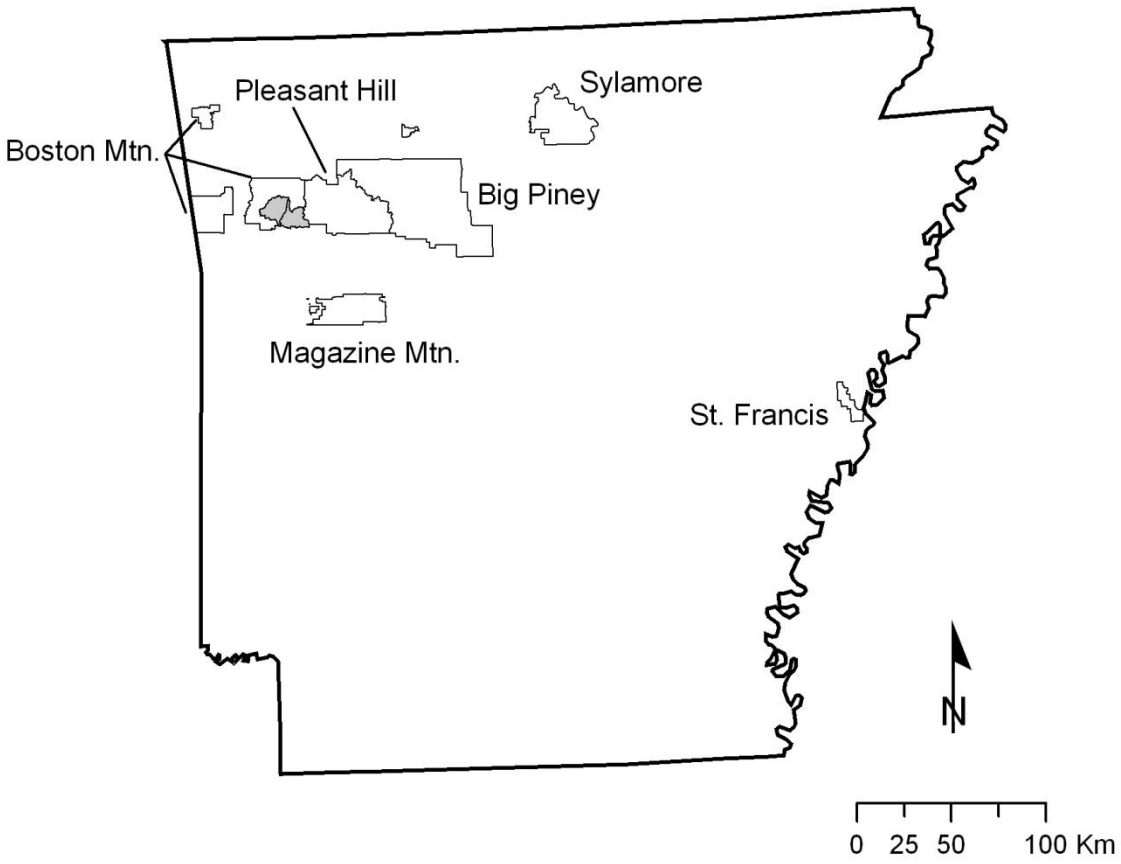

Figure 1. Ranger Districts on National Forest land in Arkansas. In June 2011 the CATT inventoried streams within watersheds (shaded in gray) in the southeastern region of the Boston Mountain Ranger District.

Table 1. Summary of stream habitat inventories by 6th level hydrologic unit code (HUC). Kilometers of habitat inventoried, number of NHD reaches visited, total number of inventories performed, and number of incomplete inventories in 6th level HUCs on the Boston Mountain Ranger District, June 2011. Incomplete inventories are due to dry streambed.

District	6th Level HUC	Km Habitat Inventoried	# NHD Reaches Visited	Total # of Inventories	# Incomplete Inventories
Boston Mountain	111102010704	12.8	6	1	0
	111102010706	24.4	13	1	0
	Total	*37.2*	*19*	*2*	*0*

Table 2. Summary of stream habitat inventories by NHD reach. Reaches visited, kilometers of habitat inventoried, number of pools and riffles electrofished, and number of pebble inventories completed on the Boston Mountain Ranger District, June 2011.

6th Level HUC	Stream Name	NHD Reach	Km Stream Inventoried	# Pools Efished	# Riffles Efished	# Pebble Inventories
111102010704	Salt Fork Creek	11110201000431	1.8	1	1	1
		11110201000432	2.1	2	1	1
		11110201000433	3.1	2	3	3
		11110201000434	1.1	1	0	0
		11110201000435	1.3	1	2	2
		11110201000436	3.3	3	2	2
111102010706	Hurricane Creek	11110201000148	2.4	2	1	1
		11110201000149	2.9	2	3	3
		11110201000150	1.0	1	1	1
		11110201000151	0.4	0	0	0
		11110201000152	0.8	1	1	1
		11110201000153	2.6	2	2	2
		11110201000154	0.4	1	0	0
		11110201000155	4.7	5	4	4
		11110201000156	1.7	2	1	1
		11110201000157	0.1	0	0	0
		11110201000158	2.2	1*	0*	0*
		11110201000159	1.3	0**	0*	0*
		11110201000160	3.9	0***	0**	0**
		Total	*37.2*	*27*	*22*	*22*
		Count of NHD Reaches	*19*	*15*	*12*	*12*

* One additional site is scheduled to be completed by Keith Whalen, ONF Fish Biologist.
** Two additional sites are scheduled to be completed by Keith Whalen, ONF Fish Biologist.
*** Three additional sites are scheduled to be completed by Keith Whalen, ONF Fish Biologist.

Table 3. Fish species captured on the Boston Mountain Ranger District, June 2011 (Note: Table does not include species that may be captured in an additional 10 habitat units on Hurricane Creek scheduled to be sampled by Keith Whalen, ONF Fish Biologist).

Family	Scientific Name	Common Name
Catostomidae	*Hypentelium nigricans*	Northern hog sucker
Centrarchidae	*Lepomis cyanellus*	Green sunfish
	Lepomis megalotis	Longear sunfish
	Micropterus dolomieu	Smallmouth bass
Cyprinidae	*Campostoma anomalum*	Central stoneroller
	Cyprinella whipplei	Steelcolor shiner
	Notropis boops	Bigeye shiner
	Notropis greenei	Wedgespot shiner
	Pimephales notatus	Bluntnose minnow
	Semotilus atromaculatus	Creek chub
Fundulidae	*Fundulus olivaceus*	Blackspotted topminnow
Ictaluridae	*Ameiurus natalis*	Yellow bullhead
	Noturus exilis	Slender madtom
Percidae	*Etheostoma blennoides*	Greenside darter
	Etheostoma flabellare	Fantail darter
	Etheostoma punctulatum	Stippled darter
	Etheostoma spectabile	Orangethroat darter
	Etheostoma whipplei	Redfin darter
	Percina caprodes	Logperch

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Appendix A: Categories used during BVET Inventories

Table A1. Size classes used to categorize substrate particles. Size was visually estimated on the intermediate axis (b-axis).

Type	Number	Size / Description
Organic matter	1	Leaves, detritus, etc.
Clay	2	Sticky, holds form when rolled into a ball
Silt	3	Slippery, does not hold form when rolled into a ball
Sand	4	Silt – 2 mm, gritty does not hold form when rolled into a ball
Small gravel	5	3 – 16 mm, sand to fingernail
Large gravel	6	17 – 64 mm, fingernail to fist
Cobble	7	65 – 256 mm, fist to head
Boulder	8	> 256 mm, bigger than head
Bedrock	9	

Table A2. Size classes used to categorize large wood during. Wood < 1.0 m in length or < 10 cm in diameter was omitted.

Category	Length (m)	Diameter (cm)
1	1-5	10-55
2	1-5	>55
3	>5	10-55
4	>5	>55
	rootwad	rootwad

Table A3. Substrate size classes used for pebble count data analysis. Bedrock was grouped in the very large boulder size class. Diameter was measured on the intermediate axis.

Size Class	Size Range (mm)
Sand	0 - 2
Very Fine Gravel	2 - 4
Fine Gravel	4 - 8
Medium Gravel	8 - 16
Coarse Gravel	16 - 32
Very Coarse Gravel	32 - 64
Small Cobble	64 - 128
Large Cobble	128 - 256
Small Boulder	256 - 512
Medium Boulder	512-1024
Large Boulder	1024-2048
Very Large Boulder	2048-4096

Appendix B: List of Microsoft Access Database Reports in 'Arkansas Bvet Efish Pebble Database.mdb'

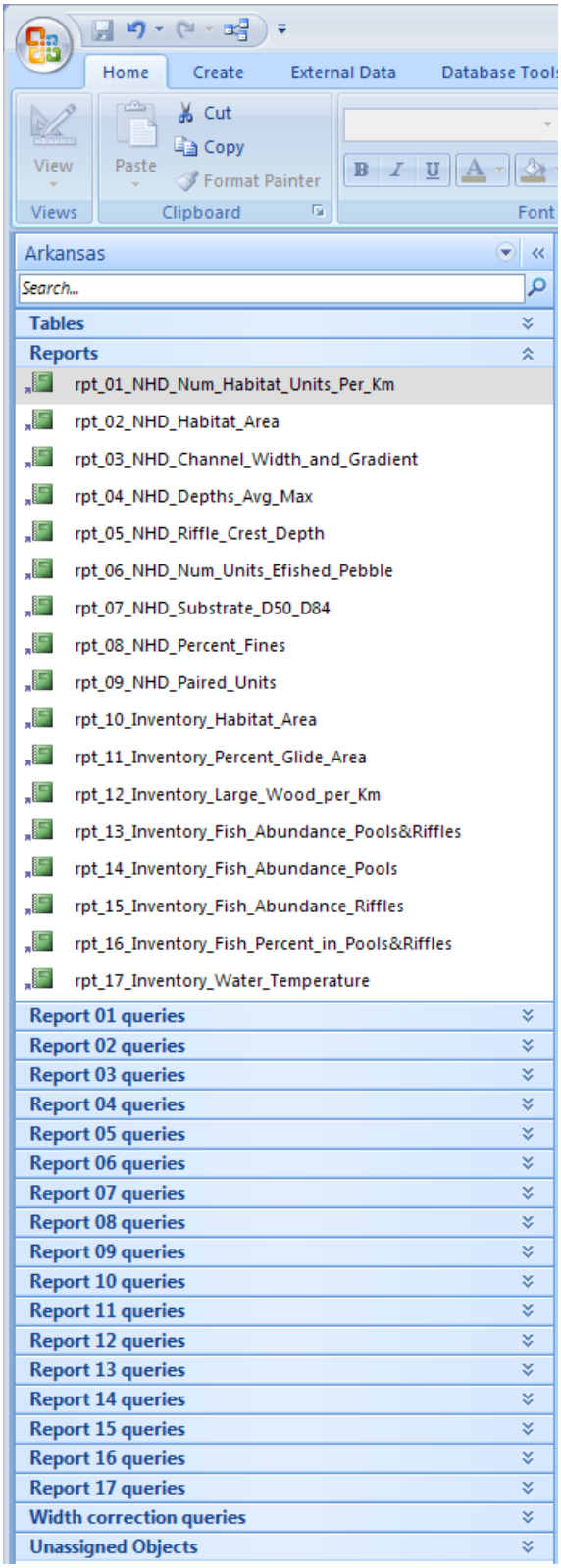
Arkansas Bvet Efish Pebble Database.mdb

'Arkansas' category display selected →

Tables containing data →

Reports summarizing data →

Queries that populate the reports →



List of Database Reports

Reports by NHD

rpt_01_NHD_Num_Habitat_Units_Per_Km

Report 1. Number of habitat units per kilometer by NHD reach and percent of the inventoried NHD reach that was underground (i.e. dry).

rpt_02_NHD_Habitat_Area

Report 2. Wetted stream habitat area (sq. m and %) for slow (pool, glide) and fast-water (riffle, run, cascade) habitat types and percent of the NHD length that was underground (dry) by NHD reach (*insufficient data for calibration of width estimates, thus preventing area calculation).

rpt_03_NHD_Channel_Width_and_Gradient

Report 3. Average bankfull channel width (m) and channel gradient (degrees) by NHD reach.

rpt_04_NHD_Depths_Avg_Max

Report 4. Average of maximum depths (cm) and average depth (cm) by NHD reach ("Dry" = underground).

rpt_05_NHD_Riffle_Crest_Depth

Report 5. Average and number of riffle crest depth (RCD, cm) measurements by NHD reach.

rpt_06_NHD_Num_Units_Efished_Pebble

Report 6. NHD reach distance inventoried (km), number of electrofished slow (pool) and fast-water (riffle) habitat units, and number of pebble inventories performed.

rpt_07_NHD_Substrate_D50_D84

Report 7. D50 and D84 (mm) substrate values from pebble inventories in fast-water (riffle) habitat units.

rpt_08_NHD_Percent_Fines

Report 8. Average of percent fines (sand, silt, clay) in habitat units by NHD reach ("Dry" = underground).

rpt_09_NHD_Paired_Units

Report 9. Number of paired slow (pool, glide) and fast-water (riffle, run, cascade) habitat units by NHD reach.

Reports by Inventory

rpt_10_Inventory_Habitat_Area

Report 10. Total wetted habitat area (sq. m for slow and fast-water habitat), percent slow (pool, glide) and fast-water (riffle, run, cascade) habitat area (sq. m), and percent of the inventory length that was underground (dry) by inventory (*insufficient data for calibration of width estimates, thus preventing area calculation).

rpt_11_Inventory_Percent_Glide_Area

Report 11. Slow-water habitat (glides only and total = pools and glides) area (sq. m and %) by stream inventory.

rpt_12_Inventory_Large_Wood_per_Km

Report 12. Large wood (LW, sizes classes 1-4) and root-wad (RW) counts per kilometer (km) by inventory (* no LW inventory).

rpt_13_Inventory_Fish_Abundance_Pools&Riffles

Report 13. Number and percent of fish by species (adults and YOY combined) captured in slow (pool, glide) and fast-water habitat (riffle, run) by inventory.

rpt_14_Inventory_Fish_Abundance_Pools

Report 14. Number and percent of fish by species (adults and YOY combined) captured in slow-water habitat (pool, glide) by inventory.

rpt_15_Inventory_Fish_Abundance_Riffles

Report 15. Number and percent of fish by species (adults and YOY combined) captured in fast-water habitat (riffle, run) by inventory.

rpt_16_Inventory_Fish_Percent_in_Pools&Riffles

Report 16. Percent of fish (adults and YOY combined) by species captured in slow (pool, glide) and fast-water habitat (riffle, run) by inventory.

rpt_17_Inventory_Water_Temperature

Report 17. Water temperature (minimum, average, and maximum; deg. C) recorded by inventory.