Regional Operational Plan CF.2A.2013.04

Operational Plan: Assessment of Pacific Salmon Escapement into the Nushagak River, 2013

by

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and

Charles Brazil

July 2013

Alaska Department of Fish and Game **Divisions of Sport Fish and Commercial Fisheries**

Symbols and Abbreviations

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Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity (negative log of)	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General

Alaska Administrative Code	AAC
all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
id est (that is)	i.e.
latitude or longitude	lat. or long.
monetary symbols (U.S.)	$, ¢
months (tables and figures): first three letters	Jan,...,Dec
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	e
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	E
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$\log_2$, etc.
minute (angular)	'
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

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July 2013

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This document should be cited as:
Buck, G. B., and C. E. Brazil. 2013. Operational Plan: Assessment of Pacific Salmon Escapement into the Nushagak River, 2013. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Operational Plan ROP.CF.2A.2013.04, Anchorage.

Signature Page

Project Title:	Nushagak River Sonar
Project leader(s):	*Greg Buck*
Division, Region and Area	Commercial Fisheries, Region 2, Anchorage
Project Nomenclature:	FM-20413
Period Covered	2013
Field Dates:	1 June-20 August
Plan Type:	Category II

Approval

Title	Name	Signature	Date
Project leader	Greg Buck		6-20-13
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PURPOSE

The Alaska Department of Fish and Game, Division of Commercial Fisheries, monitors annual escapements of salmon returning to the Nushagak River system near Dillingham, Alaska. Hydroacoustic techniques, dual frequency identification sonar (DIDSON), are used to develop escapement estimates of sockeye *Oncorhynchus nerka*, Chinook *O. Tshawytcha*, chum *O. keta*, coho *O. kisutch*, and pink *O. gorbuscha* salmon into the Nushagak River. Sonar passage estimates are used for inseason management of commercial fisheries in the Nushagak District. Estimates of species composition, age, sex, and length, are derived from samples obtained with drift gillnets. This report provides operational guidelines for the Nushagak River sonar project, estimation of salmon escapement, and sampling procedures, as well as general camp policies.

Key words: Dillingham, Bristol Bay, Nushagak River, Pacific salmon, sockeye salmon, Chinook salmon, chum salmon, coho salmon, pink salmon, DIDSON, sonar, escapement, age composition, sex composition, fisheries management, operational plan.

BACKGROUND

The Nushagak River is located in Southwestern Alaska and flows approximately 390 km from its headwaters to Bristol Bay (Figure 1). The Nushagak River drainage consists of the Nuyakuk River, which drains Tikchik Lakes from the west, and the Mulchatna River from the east. Collectively, this system supports large runs of the 5 major species of Pacific salmon (Chinook, sockeye, chum, pink and coho) as well as several resident species that are harvested in commercial, sport and subsistence fisheries.

The sonar site is located on the lower Nushagak River, approximately 40 km upstream from the terminus of the Nushagak commercial fishing district and 4 km downstream from the village of Portage Creek (Figure 1). With the exception of a small slough behind camp, the river is contained in one 300 m wide channel at this site. While this area is within tidal influence, there is rarely a reversal of flow and most fish appear to be actively migrating past this site with few fish milling in the area.

From 1956 through the late 1970s, the Alaska Department of Fish and Game (ADF&G) estimated Nushagak River sockeye escapement by means of a counting tower on the Nuyakuk River in conjunction with aerial surveys of the Nushagak River mainstem and Mulchatna River drainage. However, because aerial surveys are associated with potentially large measurement errors and salmon species of management interest are not encountered at the Nuyakuk tower, it was deemed desirable to establish an escapement enumeration project on the lower main-stem of the Nushagak that would intercept all species of interest with less measurement error than is traditionally associated with aerial surveys.

Hydroacoustic (sonar) methods have been used by ADF&G since the early 1970s to provide an index of salmon passage for several river systems across the state (Barton 2000, Chapell 2001, Davis 2002, Dunbar 2001, and McKinley 2003). In 1979, the department examined the feasibility of using sonar equipment on the Nushagak River and began developing techniques to estimate adult salmon abundance (McBride 1981). Eventually, the Nushagak River sonar project evolved to point where it reliably provided daily escapement counts to fisheries managers that were generally deemed accurate. This has greatly aided in the management of salmon runs to this important river by providing inseason run strength information and the ability to harvest surplus yields under the sustained yield principle through an escapement goal (Fair et al. 2012)

The hydroacoustic equipment used to estimate Nushagak salmon escapement from 1979 to 2004 consisted of a single beam 'Bendix' echo-counting system designed by Al Menin for the Bendix Corporation (King and Tarbox 1989). This system was comprised of an echo counter, transducer array, oscilloscope, and power supply (12-volt battery with solar panel). The Bendix sonar system does not count individual fish. Rather, it uses echo integration to sum the return signal in the ensonified zone and from that, derive a total count of fish in the ensonified zone. This requires careful calibration of the system to take into account fish size, swimming speed, and how long fish are likely to remain in the beam as these factors will determine signal strength. Unfortunately, the Bendix system only prints a final count of the estimated number of fish. Signal processing occurs entirely in short term memory and the system has no storage mechanism capable of capturing the raw signal for more detailed analysis. Eventually, a system of individual fish counts derived from oscilloscope output was developed for comparison to the Bendix counts. This allowed for some fine-tuning of the system and increased confidence in the numbers generated.

However, with the retirement of Al Menin, who had provided critical technical support and maintenance for years, ADF&G began searching for a replacement system. In 2002, ADF&G began testing the standard range (SR) dual frequency and identification sonar (DIDSON) in the Wood and Copper rivers in an attempt to determine if this system was a viable replacement for the Bendix sonars (Maxwell and Gove 2002). The much newer DIDSON sonar was originally designed at the University of Washington Applied Physics Lab (APL) to allow divers to identify mines in turbid waters. It is a high frequency, multi-beam sonar with a unique acoustic lens system that focuses the beam in order to create high-resolution, video-like images (Belcher et al. 2001; Belcher et al. 2002).

During the 2003 and 2004 field season, the SR-DIDSON was deployed on the left bank (facing downriver) of the Nushagak River for a comparative study alongside the standard Bendix deployment. The SR-DIDSON operates at 1.80 MHz and 1.10 MHz which can detect targets at ranges of 10 and 36 meters respectively. This provides approximately the same coverage as the Bendix. In 2005, the standard DIDSON replaced the Bendix for estimating salmon passage on the left bank and a SR-DIDSON unit was added to the right bank.

In 2004 and 2005, a newly developed long range (LR) DIDSON operated upstream of the Bendix on the right bank. The LR-DIDSON operates at 2 frequencies, 1.20 MHz and 0.70 MHz, which can detect targets out to 20 and 60 meters respectively. This system provides greater coverage than the Bendix system. Side-by-side comparisons of the LR-DIDSON and Bendix were completed following the 2005 season. In 2006, the LR DIDSON replaced the Bendix on the right bank (Maxwell et al. 2011).

In 2012 the historical escapement data sets for sockeye, Chinook, chum, pink, and coho salmon were updated by converting Bendix counts to DIDSON equivalents (Buck et al. 2012). Nushagak River escapement goals are reviewed on a schedule that corresponds to the Board of Fisheries three-year cycle for considering area regulatory proposals. During the previous board cycle, 2012, Nushagak River escapement goals were reviewed, and recommended changes were made by the Alaska Department of Fish and Game (Fair et al. 2012)..

While the total number of salmon passing upriver can be estimated with sonar alone, the species composition of the migrating fish is determined through test-fishing with drift gillnets.

In a separate but related project, we are tracking Chinook salmon with acoustic tags to estimate their proportion passing within the ensonified zone. This project tracks tagged fish as they pass through the sonar counting area and will attempt to determine what percentage of the Chinook pass upriver without being counted by the sonar. This project began in 2011 and is scheduled to run through 2013. The results of that project will be reported separately.

OBJECTIVES

The objectives for the Nushagak River Sonar Salmon Assessment project are to:

1. Estimate the number of adult sockeye, Chinook, chum, coho, and pink salmon that pass the Nushagak River sonar project site annually from 5 June to 20 August such that the escapement estimates are within +/- 10% of the true value 90% of the time.
2. Estimate the proportion of each of the major age classes (1.2, 2.2, 1.3, 2.3, 1.4) in the Nushagak River to within 5% of the true proportion 90% of the time.
3. Estimate the sex compositions of the escapements of sockeye, Chinook, and chum salmon in the Nushagak River such that all estimates are within +/- 5% of the true value 90% of the time.
4. Estimate the mean length by age of the escapements of sockeye, Chinook, and chum salmon in Nushagak River such that the estimates are within +/- 5% of the true value 90% of the time.
5. Collect weather observations (temperature, precipitation, water clarity, etc) on a daily basis at each of the tower sites.

METHODS

HYDROACOUSTIC COUNTING

The right and left bank DIDSON each consists of a transducer, rotator, control box, and attitude sensor connected to either a 12 V or 24 V battery bank and controlled via laptop computer running Microsoft Windows Explorer (Appendix A.1). The DIDSON's small pulse widths, high frequency, and extremely small multiple beams allow visual identification of adult salmon-sized fish targets. The relatively high frequency sound waves emitted by the DIDSON reflect off the surface of the fish as opposed to only the highly-reflective swim bladder. This creates easily distinguishable 'images' of fish in the beam and also allows operators to determine passage direction (upstream vs. downstream). Additionally, it allows accurate individual counts even when more than one fish is in the beam.

The DIDSON sonar for both banks will be assembled and placed in the river as soon as camp is established. The left bank SR-DIDSON and right bank LR-DIDSON will be placed in approximately the same location as in previous years. Each transducer will be mounted on an aluminum 'goal post' type mounting bracket for stability before being placed in the water column. Prior to deployment, cables will be inspected for nicks or worn areas, and to ensure that the correct combination of cables and transducers is used. Details on the hardware and software setup for the DIDSON sonar can be found in Appendix A.6.

A Standard Range DIDSON (SR-DIDSON) has been used to generate the inseason escapement count on the left bank since 2005. In 2013 the SR-DIDSON will be deployed to estimate salmon escapement into the Nushagak drainage. Specifications for the SR-DIDSON are shown in Appendix A.2. This unit is controlled remotely using the wireless setup diagramed in Appendix A.4.

A Long Range DIDSON (LR-DIDSON) has been used to generate the inseason escapement count on the right bank since 2006. In 2013 the LR-DIDSON will be deployed to estimate salmon escapement into the Nushagak drainage. Specifications of the LR-DIDSON are in Appendix A.3. This unit is controlled directly from camp using the setup diagramed in Appendix A.5. Sonars are aimed using the protocol outlined by Faulkner (2009).

ESCAPEMENT SAMPLING

Species Apportionment

The gillnets used for this task are 18.3 m (10 fathom) nets of mesh sizes 20.6 cm (8.125 in), 15.2 cm (6.0 in), 13.0 cm (5.125 in), and 11.4 cm (4.5 in). All are composed of mono twist filament webbing dyed either Momoi shade #3 or Tairyo shade #T-14 (both are translucent light green). Twine size is dependent upon mesh size with 13.0-cm and 15.2-cm mesh gillnets using a Momoi #63 twine size, and the 20.6-cm mesh gillnets constructed from Momoi #93 (or equivalent) twine. The 13.0 cm and 15.2 cm gillnets are hung 45 mesh (approximately 4-5 m) deep while 20.6 cm gillnets are hung 29 mesh (approximately 5-6 m) deep. These gillnet configurations are sufficiently deep to fully sample the entire water column. All four configurations will be fished during even years when pink salmon are present. Only the 3 largest will be fished during odd years.

Five species of salmon occur in the Nushagak River, requiring that daily sonar counts be apportioned to species. This will be accomplished using the catch-per-unit-effort (CPUE) of species caught in various size gillnets (Miller et al. 1994a; Miller 1995). No adjustment for net selectivity will be made, based on the work of Brannian et al. (1995) and Miller et al. (1994a) who conclude that in order to adjust for selectivity, selectivity curves would need to be estimated using fish length or girth data, which is not currently collected on the Nushagak River sonar project. Current belief is that selectivity information would provide little benefit because of the relatively small number of species to be apportioned. Miller et al. (1994b) and Miller (1995) found that 13.0 cm and 15.2 cm mesh gillnets were not size selective for sockeye, chum, or Chinook salmon. The 20.6 cm mesh gillnet, however, tended to select for large sockeye and chum salmon. Therefore, only 13.0 cm and 15.2 cm mesh data will be used to apportion sockeye, chum, and coho salmon, while data from all but the 11.4 cm net will be used to apportion Chinook salmon. Only pink salmon caught in the 11.4cm net will be used for apportionment.

A stratified sampling design will be used to develop species-specific escapement estimates. Strata are defined by riverbank and distance from shore (left inshore, left offshore, right inshore and right offshore). Sonar counts will be apportioned by species based on the gillnet CPUE from each stratum. This apportionment will be conducted daily. Each gillnet configuration will be fished for a minimum of 2 drifts inshore and 2 drifts offshore on each bank during each drift session. During the period of peak sockeye salmon passage drift sessions will be conducted 3 times daily: morning (0800-1100 hours), mid-day (1300-1600 hours), and evening (1800-2100 hours). Prior to June 15 and after July 14, drift sessions will be conducted twice daily: mid-morning (0900-1200 hours) and early evening (1600-1900 hours). Drifts will not be conducted at night or in otherwise poor light conditions for safety reasons. Each drift session, each of the 3 nets in use (20.6cm, 15.2cm and 13.0cm through late July when the 20.6cm net is replaced with the 11.4cm net) will be drifted twice in each stratum.

Age, Sex, and Length Composition

Age, sex and length (ASL) data will be collected from all Chinook, chum, and sockeye salmon sampled during apportionment sampling. This information is used by management and research biologists to 1) forecast returns, 2) evaluate escapement goals, 3) examine the productivity of each river system, 4) analyze salmon growth, 5) estimate inseason run strength, 6) allocate catch based on age composition, and 7) improve biological understanding.

A sampling goal of 480 salmon per stratum allows us to estimate the proportion of each age class within 5% of the true value 90% of the time (Thompson 1987). This sample size takes in to account that approximately 20% of the scales are regenerated, reabsorbed or otherwise illegible (Tim Baker, personal communication). Sampling will be stratified by time-period (early, middle and late run) for sockeye salmon. Chinook and chum samples will not be stratified by time. Therefore, our season total sampling goals sum to 1,440 sockeye; 480 Chinook, and 480 chum salmon. This level of sampling will ensure that objective criteria will be met for objectives 3 and 4. Estimates of age composition will be compared post-season for sockeye between time strata using a chi-square analysis (Snedecor and Cochran 1980). Age composition estimates will be combined when there are no significant ($\propto <= 0.05$) differences between successive time-period strata.

DATA COLLECTION

Hydroacoustic Counting

The SR DIDSON (SN-24) will be deployed on the left bank using a wireless setup so that data can be processed in the operations center located on the right bank. Left bank DIDSON counts will be divided into two 10-minute hourly counts by strata: (1) near-shore, 1-10 meters (1.8Mhz), and (2) offshore, 10-30 meters (1.1Mhz). The LR DIDSON (SN-115) will be deployed on the right bank in approximately the same location as the Bendix sonar counter was located in previous years. Right bank DIDSON counts will be divided into two 10-minute hourly counts and strata: (1) near-shore, 1-10 meters (1.2Mhz), and (2) offshore, 10-50 meters (0.7Mhz). DIDSON files will be written to an external Maxtor hard drive. The right bank sonar unit will be operated via a networked laptop in the operations center. All DIDSON files will be stored on external hard drives.

Test Fishing

The data recorded for each gillnet drift includes: (1) date, (2) drift session number (1= morning, 2= afternoon, 3=evening), (3) boat operator, (4) drift number sequentially ordered through season, (5) mesh size, (6) river bank (left or right), (7) location (LBO, left bank-offshore), (8) fishing time, (9) number and species of catch, (10) length of each fish caught: mid-eye to fork-of-tail to nearest 5 millimeter, (11) sex as determined from external characteristics, (12) one scale will be retained from each sockeye and each chum salmon caught in the 15.2 cm and 13.cm mesh gillnets, and (13) 3 scales from each Chinook salmon caught in the 15.2 cm, 13.0 cm, and 20.6 cm mesh gillnets. The following times will be determined using a stopwatch for each drift:

Time net start out - Min and Sec

Time net start in - Min Sec

This data will be recorded on pre-printed waterproof drift forms (Appendix A6). It is the responsibility of the drift crew to ensure data are entered into the database in a timely manner (shortly after completing the test fish session) by the sonar technician on duty.

For sockeye and chum salmon, one scale will be collected from the left side of the fish approximately 2 rows above the lateral line in the area crossed by a diagonal from the posterior insertion of the dorsal fin to the anterior insertion of the anal fin (INPFC 1963). Because of the high rate of scale regeneration among Chinook salmon, 3 scales will be collected from each fish (Appendix 7). Scale numbers 2 and 3 will be collected immediately to the left and right of the preferred scales on row number 2 above the lateral line. Scales will be mounted on corresponding gum cards, which will be covered with wax paper after drying and placed in a press to keep from curling. Fish will be measured to **the nearest millimeter** from the mid-eye to fork-of-tail (Appendix 8). Sex is determined from morphological characteristics, such as kype development, or protruding ovipositor (Groot and Margolis 1991). Sex, length and species will be recorded on Write-in-the-Rain forms entitled Nushagak Sonar Drift Gillnet Data while field sampling.

DATA REDUCTION AND ANALYSIS

Hydroacoustic Counting

The sampling design for the DIDSON sonar counts consists of one 10-minute count per hour per strata (left bank inshore, left bank offshore, right bank inshore, right bank offshore). The total count ($\hat{n}_{tk}$) for a period and strata is:

$$\hat{n}_{tk} = \sum_{h=1}^{h^t} 6\hat{n}_{tkh} \qquad (1)$$

where, $\hat{n}_{tkh}$ = 10 minute count during hour h within period t^k and strata k. Note that there are j^{tk} days and h^{tk} hours in period t^k.

The variance is estimated using Wolter's (1984, 1985) V5 estimator for systematic sampling scheme. This has been found to be the least biased estimator for tower-based escapement estimation projects which use a similar 10-minute per hour counting methodology (Reynolds et al. 2007). Note that it is not possible to develop unbiased estimates of variance with a systematic sampling scheme (Cochran 1977, Wolter 1984, 1985). Nor is it feasible to implement stratified random sampling for the Nushagak River because of limited crew sizes. The approximate variance estimators for systematic sampling are usually biased high (i.e., overestimate the precision of the escapement estimates); however, this bias has been found to be much less than with the higher order V2, V3 and V4 estimators proposed by Wolter (1984, 1985) (Skalski 1992). The variance for period t, strata k and hour h is calculated as:

$$Var(\hat{n}_{tkh}) = \frac{(1-f)}{h^{tk}(3.5(h^{tk}-4))}\sum_{h=1}^{h^{tk}}(\frac{n_{kh}}{2} - n_{kh-1} + n_{kh-2} - n_{kh-3} + \frac{n_{kh-4}}{2})^2 \quad (2)$$

where, f = sampling rate. Total variance by time period *t* and strata *k* is:

$$\mathrm{Var}(\hat{\mathrm{n}}_{\mathrm{tk}}) = (6h^{tk})^2 Var(\hat{n}_{tkh}) \quad (3)$$

Sonar counts for each strata will be apportioned by species for each time period *t*. Escapement estimates for each salmon species *i*, strata *k* and time period *t* ($\hat{N}_{itk}$) will be based on estimates of

$$\hat{N}_{itk} = \hat{S}_{itk}\,\hat{n}_{tk} \quad (4)$$

species proportions ($\hat{S}_{itk}$) from escapement sampling and period sonar counts ($\hat{n}_{tk}$):

Escapement ($\hat{N}_{it}$) by species *i* and time period *t* will be estimated by summing area strata estimates.

$$Var(\hat{N}_{ijk}) = \hat{n}_{tk}^2 Var(\hat{S}_{itk}) + \hat{S}_{itk}{}^2 Var(\hat{n}_{tk}) - Var(\hat{n}_{tk})Var(\hat{S}_{itk}) \quad (5)$$

The variance of $\hat{N}_{ijk}$ after Goodman (1960) is:

$$V(\hat{N}_{it}) = \sum_{k=1}^{4} Var(\hat{N}_{itk}) \quad (6)$$

While the total variance $V(\hat{N}_{it})$, across all strata is:

Cumulative numbers of salmon will be calculated by summing daily estimates, with total variance the sum of the daily variances.

Counts are recorded in the logbook provided for each bank (Appendix A6) along with other information on the current state of the sonar and climatological observations. Logbook data are entered into an ACCESS database (Appendix A7). Additional sonar shift duties are detailed in

Appendix A8. Cumulative sonar counts for each area strata (left and right bank, inshore and offshore) are reported at 0600, 1000, 1400, 1800, and 2400 hours. Instructions on extracting reported information from the database is located in Appendix A8.

Species Apportionment

The catch per unit effort (CPUE) metric used is fathom hours. Fishing time (*FT*) will be measured in minutes and seconds and calculated for each drift as:

$$FT = RI - FD \ , \tag{7}$$

where *FD* is the point in time when the net is fully deployed and *RI* is the point in time when net retrieval is initiated. Fathom hours (*FH*) is defined as:

$$FH = \frac{f\,FT}{60} \ , \tag{8}$$

where *f* is net length in fathoms (generally 10). CPUE for each salmon species (group) will be based on species-specific mesh sizes. CPUE for each species (*i*) on day *j* in strata *k* will be calculated by summing across the number caught (C_{ijkmn}) with mesh size (*m*) and drift (*n*):

$$CPUE_{ijk} = \frac{\sum_{m=1}^{3}\sum_{n=1}^{6} u_{im}\, C_{ijkmn}}{\sum_{m=1}^{3}\sum_{n=1}^{6} u_{im}\, FH_{jkmn}} \ , \tag{9}$$

where u_{im} equals 1 if species *i* from mesh *m* is used to estimate species composition, and u_{im} equals 0 otherwise. CPUE will be summed across days to create time (*t*) and area estimates of species composition. The duration of each report period varies by range and bank. Catches are summed until the minimum sample size (5) is obtained from all gear types to define a reporting period. If there are j^{tk} days in period *t* and strata *k*, the CPUE used to estimate the proportion of species *i* in report period *t* and area strata *k* is:

$$CPUE_{itk} = \sum_{j=1}^{j^{tk}} CPUE_{ijk} \tag{10}$$

Estimates of the proportion (S_{itk}) of species *i* for report period t^k and area strata *k* are:

$$\hat{S}_{itk} = \frac{CPUE_{itk}}{\sum_{i=1}^{5} CPUE_{itk}} \tag{11}$$

Where the variance of $\hat{S}_{itk}$ will be estimated assuming that gillnet sampling gear is not selective and that the probability of capture is equal amongst the mesh sizes used:

$$Var(\hat{S}_{itk}) = \frac{\hat{S}_{itk}(1-\hat{S}_{itk})}{C_{tk}-1} \tag{12}$$

The distribution of species caught is assumed to be multinomial. If effort were constant among species the sample size would be equal to the total number of fish caught during that period. However, since a suite of gillnets are used, with 1, 2, 2, 2,and 3 mesh sizes targeting pink, sockeye, chum, coho, and Chinook salmon, respectively; the catches need to be adjusted on this relative effort. Therefore, the effective sample size (C_{tk}) is:

$$C_{tk} = \sum_{i=1}^{5}\sum_{j=1}^{j^t}\sum_{m=1}^{3}\sum_{n=1}^{6} u_{im}\, C_{ijkmn}\, w_i \tag{13}$$

where, $w_i = 2,1,1,1,0.67$ for pink, sockeye, chum, coho, and Chinook salmon, respectively. The sonar counts will be apportioned daily to species at midnight by the technician on duty using the R script provided (Appendix A8).

AGE, SEX, AND LENGTH COMPOSITION

Data collected from test fishing sessions are recorded in the AWL logbook (Appendix A10). At approximate 2 week intervals, this information is transferred to AWL bubble sheets and sent to King Salmon along with all scale samples collected to date. AWL shipping information is recorded in the back of the AWL logbook.

SCHEDULE AND DELIVERABLES

Each year the sonar will be installed and operational by the end of the first week of June and operated until approximately August 20. Project operation dates have varied over the years. From 1982-2002 (except 1992), the project operated from early June through at least August 17. In 1992, the project terminated on July 22 due to budget shortfalls. For similar reasons, the project was terminated around July 20 in 2003, 2005, 2006 and 2007. In 2004, the Bristol Bay Science & Research Institute (BBSRI) made up the budget shortfall, allowing the project to run through August 18. In 2012 addition funding was obtained to operate through 20 August.

Information on daily and cumulative salmon passage will be communicated to the Nushagak District fishery management staff on a daily basis. Age, sex, and length data will be forwarded to the ADF&G office in King Salmon weekly throughout the season for analysis. Data collected will be analyzed and reported in an annual ADF&G peer reviewed Fisheries Data Series Report.

RESPONSIBILITIES

Greg Buck, Assistant area research Biologist-Bristol Bay, ADF&G. Duties: Project manager. Oversee budget, hiring, and logistics. Primary author of operational plan, progress reports and final technical report.

Suzanne Maxwell, Region II Sonar Coordinator, ADF&G. Duties: Oversee installation and setup of the SR-DIDSON and LR- DIDSON. Provide hydroacoustic review for all reports. Provide technical support and advice on the collection of sonar data.

Charles Brazil, Bristol Bay Area Research Biologist, ADF&G. Duties: Assists in preparation of the project operational plan. Reviews and approves progress and final reports.

Xinxian Zhang, Biometrician, ADF&G. Duties: Provide statistical supervision and assist in project design. Provide statistical review of data analysis. Provide biometric review of reports.

Konrad Mittlestadt, Crew Leader, ADF&G. Duties: Supervise a crew of 5 ADF&G Fish and Wildlife Technicians, and monitors the work of one or 2 technicians from various other agencies. Assist project biologist in planning and execution of field logistics. Assist project leader in overseeing daily sonar and test fish operations. Prepare work schedule and assist with data collection.

Fishery Technicians, ADF&G. Duties: Conduct daily sonar operations, test fishing, and data collection. Assist in mobilization and demobilization of field camp and maintenance.

Cathy Tilly, Fish and Wildlife Technician, ADF&G. Duties: Ages scales from Nushagak Sonar test fishing and completes mark-sense forms.

Fred West, Assistant Area Research Biologist, ADF&G. Duties: Edits and combines age composition with escapement and catch data and writes season summary.

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Table 1 – Budget for the Nushagak Sonar Project

Line Item	100	200	300	400	500	Total
Nushagak River Sonar (11120413)						
Allocation	$ 78,400.00	$ 2,000.00	$ 4,500.00	$ 7,600.00	$ -	$ 92,500.00
Obligated	$ 94,234.72	$ -	$ 2,087.98	$ 4,949.76	$ -	$ 101,272.46
Balance	$ (15,834.72)	$ 2,000.00	$ 2,412.02	$ 2,650.24	$ -	$ (8,772.46)
Projected Expenses	$ 6,047.02	$ 1,350.00	$ 10,465.00	$ 8,870.15	$ -	$ 26,732.17
Projected Balance	$ (21,881.74)	$ 650.00	$ (8,052.98)	$ (6,219.91)	$ -	$ (35,504.63)
Nushagak River Enhancement (11120418)						
Allocation	$ 58,000.00	$ 4,000.00	$ 8,000.00	$ 15,000.00	$ 10,000.00	$ 95,000.00
Obligated	$ 0.01	$ -	$ -	$ -	$ -	$ 0.01
Balance	$ 57,999.99	$ 4,000.00	$ 8,000.00	$ 15,000.00	$ 10,000.00	$ 94,999.99
Projected Expenses	$ 52,000.00	$ -	$ -	$ 7,970.15	$ -	$ 59,970.15
Projected Balance	$ 5,999.99	$ 4,000.00	$ 8,000.00	$ 7,029.85	$ 10,000.00	$ 35,029.84

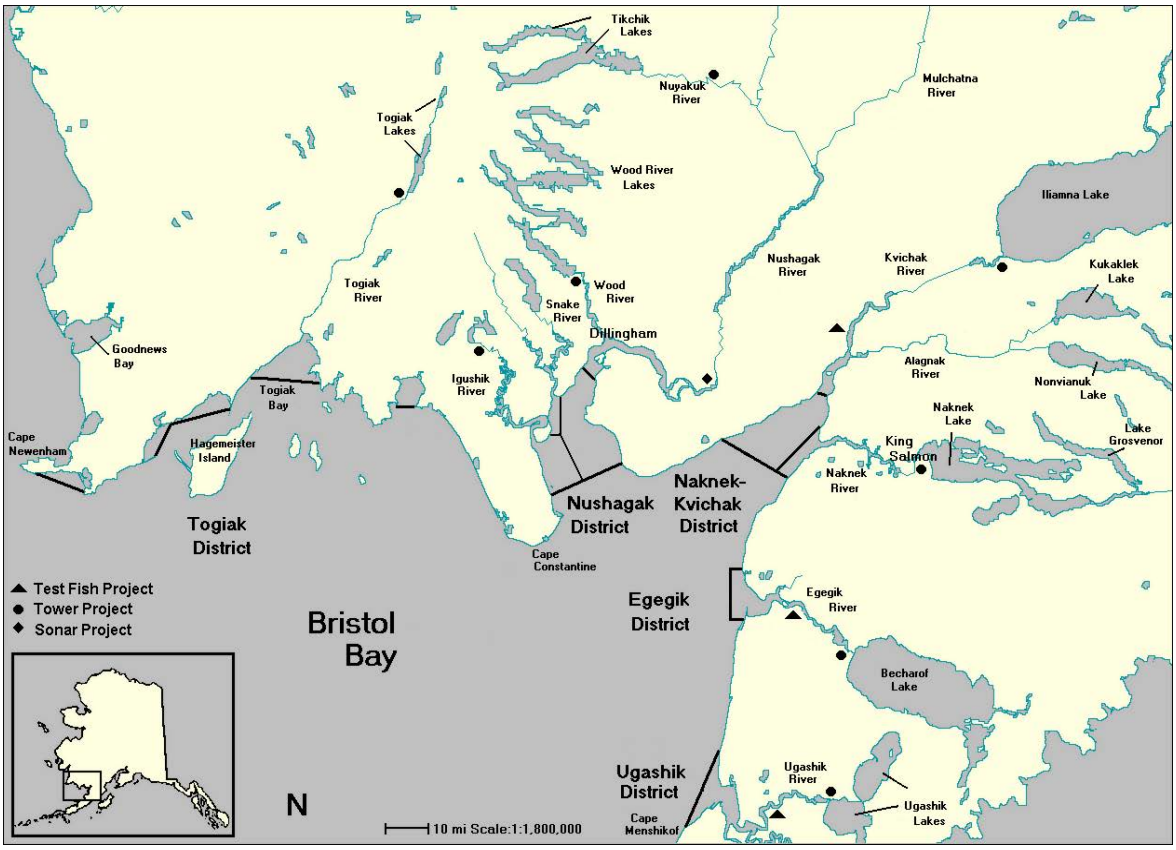
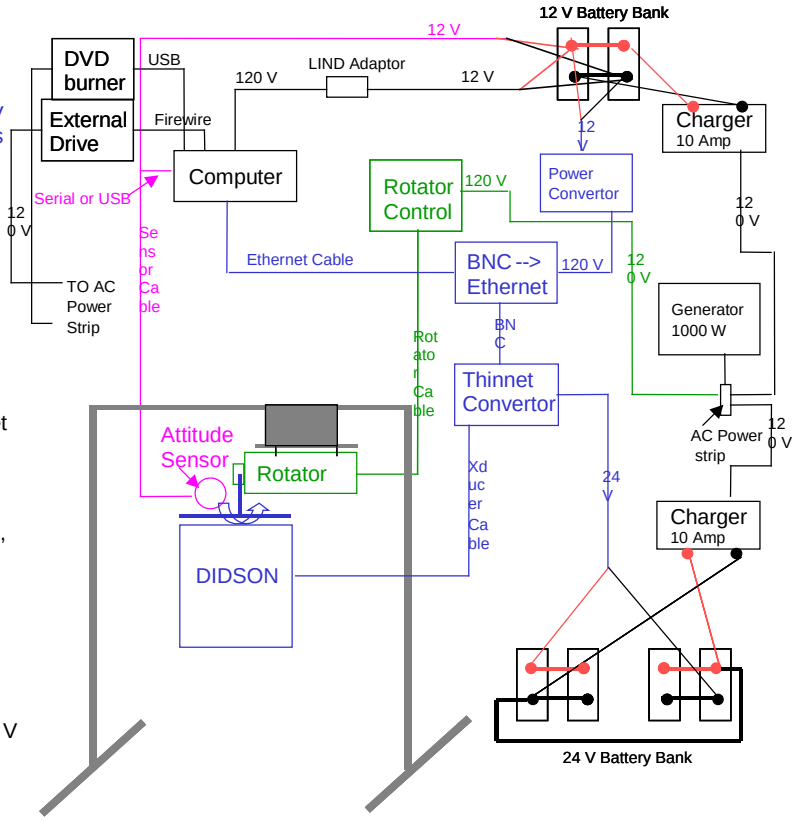


Figure 1- Bristol Bay commercial fishing districts and escapement enumeration projects. The Portage Creek (Nushagak River) sonar site is framed by the box.

Appendix A1– DIDSON setup.

- DIDSON
  - Xducer
  - Mounting bracket
  - Xducer Cable
  - Thinnet Convertor- 24 V
    - Banana plug to ring
  - BNC-Ethernet Box- 120 V
  - Ethernet and BNC cables
- Rotator (single axis)
  - Attach to mount
  - Rotator cable
  - Rotator Control Box
  - 120 V AC power
- Attitude Sensor
  - Sensor Cable
  - Serial or USB Cable
  - Plate (with Bio sensor)
  - Stainless hose clamps- 4
- Computer
  - Lind Adaptor
  - Serial, USB, and Ethernet ports
  - 120 --> 12 V
  - DVD and External Drives
- Hardware
  - DIDSON: 1/4"-20 UNC-2B, 0.38" hole depth
  - Rotator:
  - Mount:
- Power
  - 12 V battery bank (2)
  - 24 V battery bank (4)
  - 2 Chargers (10 Amp)
  - Heavy duty wires
  - Power Convertor 120->24 V
  - 1000 W generator



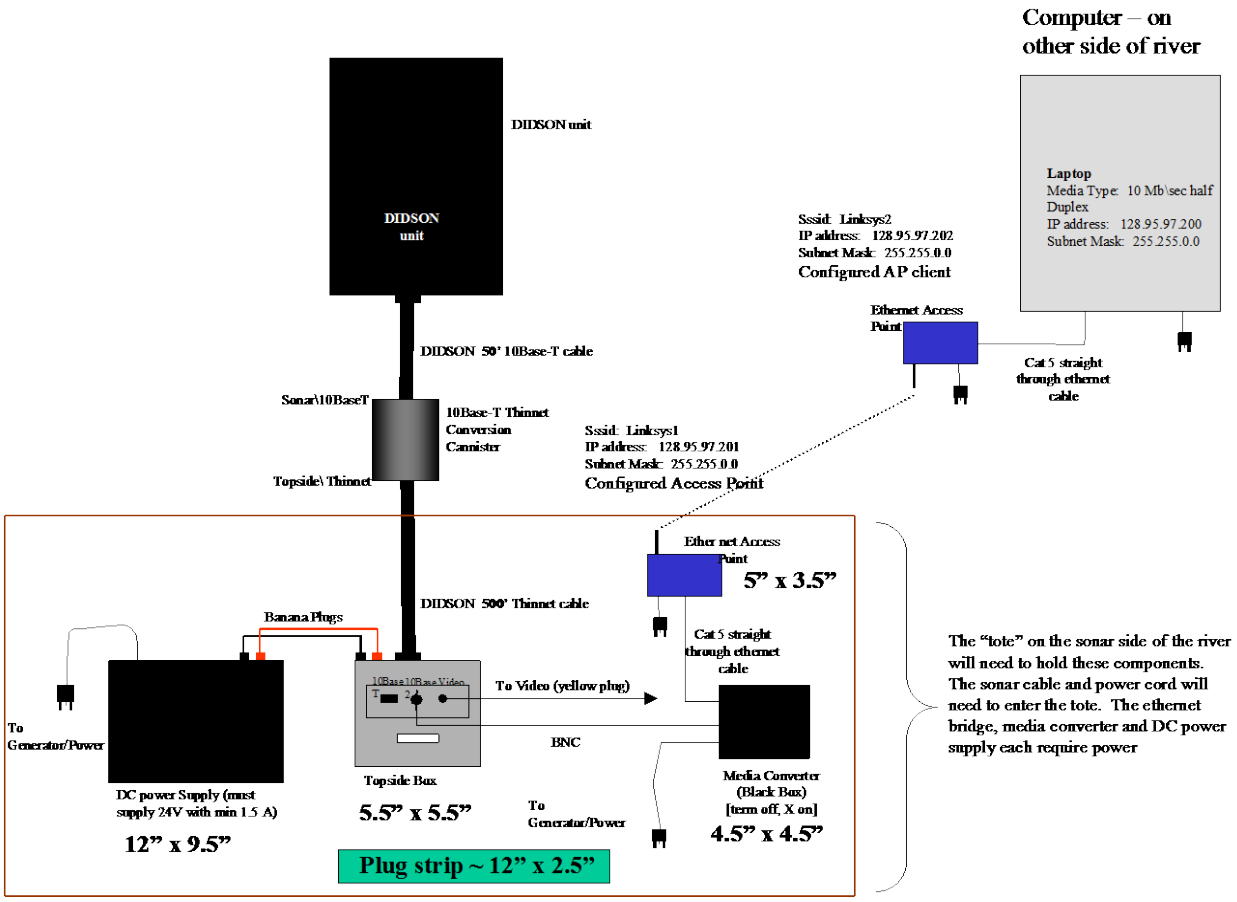
Appendix A2– Short Range DIDSON Specifications.

Detection Mode	
Operating Freq:	1.10 MHz
Beamwidth (two-way):	0.4° H by 12° V
Number of Beams:	48
Range Settings:	
Start Range:	0.75 m to 23.25 m in 0.75 m intervals
Window Length:	4.5m, 9 m, 18 m, 36 m
Range-bin size relative to window:	8 mm, 17 mm, 35 mm, 70 mm
Pulse length relative to window length:	16 µs, 32 µs, 64 µs, 128 µs
Identification Mode	
Operating Freq:	1.80 MHz
Beamwidth (two-way):	0.3° H by 12° V
Number of Beams:	96
Range Settings:	
Start Range:	0.38 m to 11.63 m in 0.38 m increments
Window Length:	1.13 m, 2.25 m, 4.5 m, 9 m
Range-bin separation:	2.2 mm, 4.4 mm, 9 mm, 18 mm
Both Modes	
Max frame rate (window length dependent):	4-21 Frames/s
Field of view:	29°
Remote focus:	1 m to maximum range
Power Consumption:	30 Watts typical
Image Uplink:	Ethernet and NTSC Video
Dimensions:	30.7 cm long by 20.6 cm high by 17.1 cm wide
Depth rating:	150 m (500 feet)
Weight in air:	7.3 kg (16.1 lb.)
Weight in water:	0.8 kg negative (1.8 lb.)

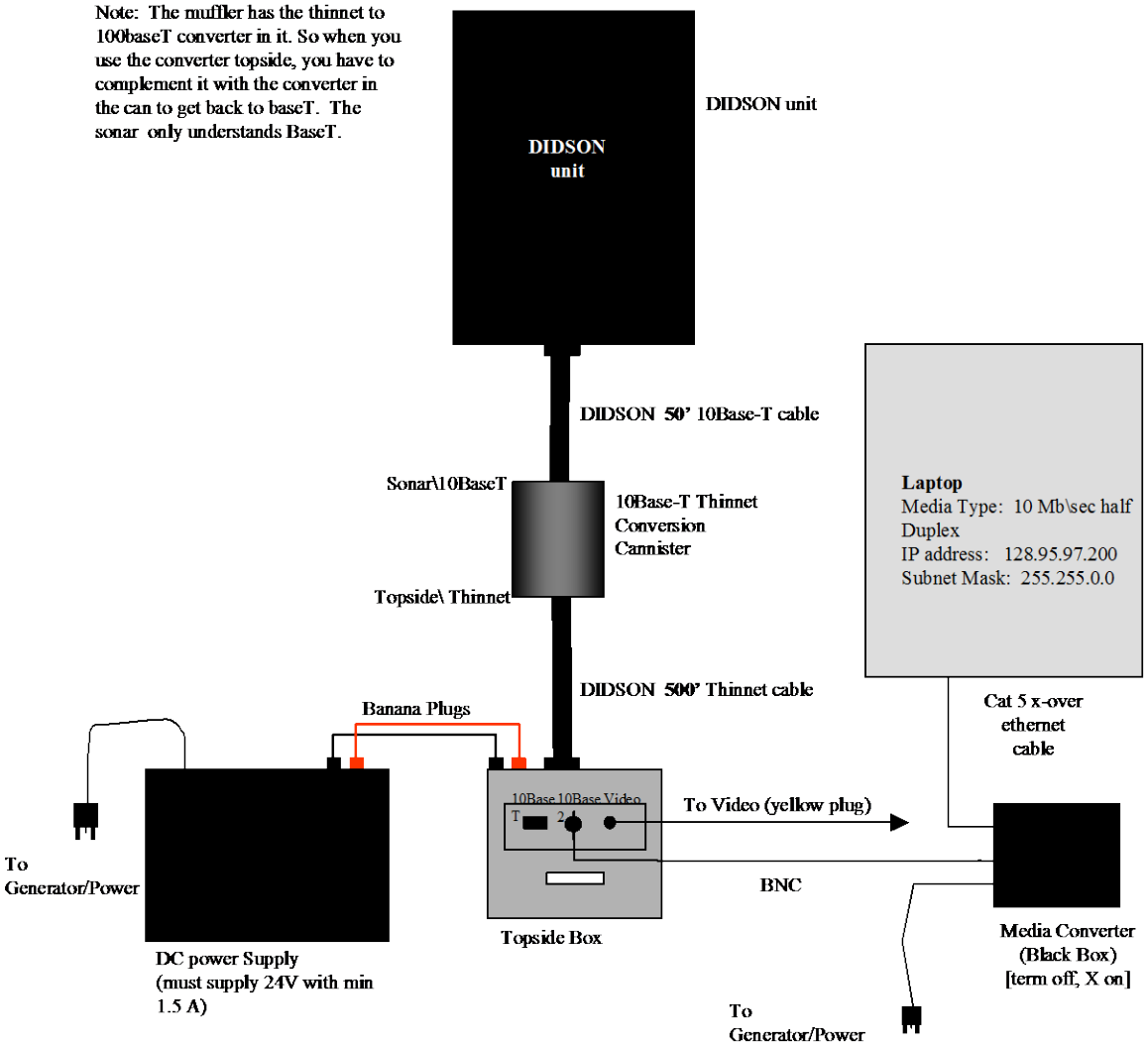
Appendix A3.– Long Range DIDSON Specifications.

Detection Mode	
Operating Freq:	0.70 MHz
Beamwidth (two-way):	0.8° H by 12° V
Number of Beams:	48
Range Settings:	
Start Range:	0.75 m to 23.25 m in 0.75 m intervals
Window Length:	9 m, 18 m, 36 m , 72 m
Range-bin size relative to window:	17 mm, 35 mm, 70 mm, 140 mm
Pulse length relative to window length:	23 µs, 46 µs, 92 µs, 184 µs
Identification Mode	
Operating Freq:	1.2 MHz, 0.7 MHz
Beamwidth (two-way):	0.5° H by 12° V
Number of Beams:	48
Range Settings:	
Start Range:	0.38 m to 11.63 m in 0.38 m increments
Window Length:	2.25 m, 4.5 m, 9 m, 18 m
Range-bin separation:	4.4 mm, 9 mm, 18 mm, 36mm
Both Modes	
Max frame rate (window length dependent):	2-10 Frames/s
Field of view:	29°
Remote focus:	1 m to maximum range
Power Consumption:	30 Watts typical
Image Uplink:	Ethernet and NTSC Video
Dimensions:	30.7 cm long by 20.6 cm high by 17.1 cm wide
Depth rating:	150 m (500 feet)
Weight in air:	7.3 kg (16.1 lb.)
Weight in water:	0.8 kg negative (1.8 lb.)

Appendix A4.– Wireless Setup Left Bank DIDSON



Appendix A5.– DIDSON Setup using 50’ and 500’ cable.



Appendix A6.– Getting Started With DIDSON (Ed Belcher, Unpublished).

15 May 2004

New Installations

Put in the installation CD-ROM and follow the prompts. If the installer does not start automatically double-click on setup.exe.

1. On the installer page that allows you to choose between "Everyone" and "Just Me", use the default "Everyone". This will allow future automatic removal of the current installation when upgrading to a newer version.

2. The default installation folder is "C:\Program Files\SMC\DIDSON".

3. Allow the system to create the folder “DIDSON Data”. The default is on the C: drive.

4. Use the command "Edit->Didson.ini File" to customize your topside software to your DIDSON sonar. There are a number of options, but to start with let’s concern ourselves with five:

a) Input the IP address: unless you specified a different sonar IP address, the sonar has the default address which is: 128.95.97.227. The subnet mask should be 255.255.255.0

b) Sonar Serial Number SNXXX (read that off the endcap of the sonar).

c) Mount Orientation: If sonar is mounted in the water with lens compartment at top then check TOP.

d) If your sonar is a LR (Long Range), be sure to check the LR box. Otherwise your display will be out of sync.

e) If the temperature and salinity values are correct for your environment, then focus will be optimized at the center range of the display. These corrections provide minor changes. In general, brackish and 10-20 C give good results independent of your environment.

5. Make sure the "Edit->Demo Mode" flag is NOT checked if you are connecting to the sonar. Demo Mode is used to learn commands when no sonar is attached, or for playback only use.

6. Use the application "Help" command for more information on connecting and running the sonar.

7. Select Image -> Record Options -> Make sure that none of the far left squares is checked. As you learn more about the software you may want to check some of them. Until you read about these options leave them unchecked or you may get unexpected results.

Set up your PC with a fixed IP Address

The default IP address for the PC is 128.95.97.100. Note that the last number (.100) must differ from the one used in the *Didson.ini* file for the Sonar.

If you are using Windows XP:

Click on Start->Control Panel->Network & Internet Connections->Network Connections->Local Area Connections->General tab. Properties->Internet Protocol should be checked. Select it and click on Properties. Select “Use Following IP Address” “IP Address:” enter 128.95.97.100.

For the subnet mask enter 255.255.255.0. Other settings may be left alone. Click on OK to apply the new settings.

If you are using Windows 2000:

Start->Settings->Network and Dial-up Connections->Local Area Connection->

Check and Select "Internet Protocol (TCP/IP). Select "Use the following IP Address" and enter 128.95.97.100 for the IP address and 255.255.255.0 for the subnet mask. The rest of the settings need not be changed. Click on OK to apply the new settings.

If you are using Windows 95/98:

See topside application Help->Help Topics->Network Setup "For Windows 95/98"

III. Connecting the Components *(see diagrams as well)*

Power

The default sonar power requirement is 14-32 Vdc (*at the sonar end of the cable*). For this configuration we have supplied a 24 Vdc supply that runs off 100-240 Vac line voltage. You can also use two 12 Vdc batteries in series. The supply is in the accessories kit. Turn topside box power switch to "off". Connect the 24 Vdc supply to topside box for default voltage requirements.

Cable up to 200 feet

10/100 BaseT (Cable up to 200 ft long)

When operating with BaseT (black cable) on cable lengths up to 200 feet, your Ethernet connection may be set to 100 or 10 Mbits/s. Most cards default to "Auto Negotiation", which will normally be 100 Mbits/s. If your sonar has difficulty connecting, or the connection seems sporadic ("red squares" flashing in the image display window) try forcing your Ethernet connection to 10 Mbits/s. This is more likely to occur for cables between 100 and 200 ft long.

To force the connection to 10 Mbits/s, navigate to the "Local Area Connections->General" tab as during system setup, and then click on the "Configure" button under the "Connect using:" window. Click on the "Advanced" tab and find the "Link Speed" or similarly named property. Select either 10 Mbit/s Full or 10 Mbit/s Half mode, then click OK until all windows are closed.

Cable longer than 200 feet (Patton Ethernet Extender)

Turn topside box power switch to "off". Connect long cable between topside box and media converter housing. Be sure the long cable is connected to the connector marked Topside on the in-line media converter housing. Connect the 50-ft cable between the media converter housing (the connector marked Sonar) and the sonar. Connect 24 volts to topside box. Connect computer Ethernet port to the Patton Ethernet converter Ethernet port. Use the supplied 10-ft "crossover" Ethernet cable. That means "in" pins on one end are connected to "out" pins on the other end. Connect the short (2-ft) cable from the Copperlink port on the Ethernet Extender to the Ethernet port on the topside box. You may also connect an optional video monitor to the video connector on the topside box. The Patton Ethernet Extender requires 5 Vdc. A 5 Vdc supply is supplied in the accessories kit. *See diagram*.

The in-line Media Converter in the waterproof housing can overheat. If you leave it in air, the electronics in the housing can overheat and quit working. It can work in air if the temperature is

cool (we don't have specific numbers, sorry!) and the housing is in the shade. Otherwise, you can always plunk it in a bucket of water or in the water where the sonar is. In general, if the housing feels cool to the touch, it is probably OK. The housing is rated to 150 m depth so don't worry about submerging it in water.

There will be times when you don't need the long cable to your sonar. No problem. Just connect the 50-ft cable from the sonar to the topside box and follow the instructions for cables up to 200 ft long.

IMPORTANT: In topside software go to Sonar Menu and Select Packet Transfer in Ethernet Transfer mode.

IV. Topside Application

After components are connected, start up the topside application. Make sure you are not in Demo mode (uncheck Demo Mode in the Edit menu). If you are using the Ethernet Extender, open the Sonar Menu, go to Ethernet Transfer Mode, and select Packet Transfer.

Power the Ethernet Extender (if needed) then turn on the power switch on the topside box. The sonar should start its boot procedure. If you have a video monitor you can watch the sonar progress through the boot sequence. At the end of the boot sequence the sonar will connect to the topside computer. The "NO SERVER" message displayed at the bottom of the topside application window will change to "CONNECTED."

Put the sonar in water. It can overheat if left on and in air. You can read the sonar temperature on the topside application in the Sonar Status "A/D-PS:' We have temperature sensors on the A/D card and on the Power Supply card. They should read under 50˚C for the best long-term reliability. The application will warn you if the sonar is in danger of overheating.

A few commands to get you started…make sure Auto Freq and Auto Rate are checked. Click the up-arrow for Window Start. Note that the starting point (minimum range) on the display increases. You may also type in a number and when you press enter, it will start at a range that is as close as possible to that number.

Click the up-arrow for Window Length. Note the window length doubles. These two commands control the start and end ranges for the display. You will read in the documentation that you can also use your mouse on the display to make changes as well. For standard frequencies, you will notice that when the maximum range exceeds 15 m, the sonar changes to 1.1 MHz (Low Frequency). When you reduce the window length and/or start range so the end range is less than 15 m, the sonar will switch back to HF (1.8 MHz). *Smooth* should be checked. That makes the image pixels less blocky.

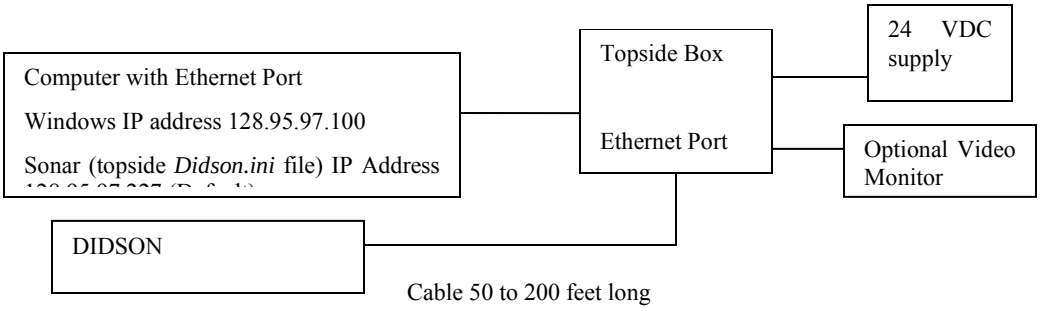
OK. You are on your own to learn a lot more. For starters, you can click on the Question Mark in the top tool bar, then click on a command of interest. You will get on-line help. In the help section you have an on-line manual with lots of material you can read and make hardcopies as you wish.

V. Turning the sonar off

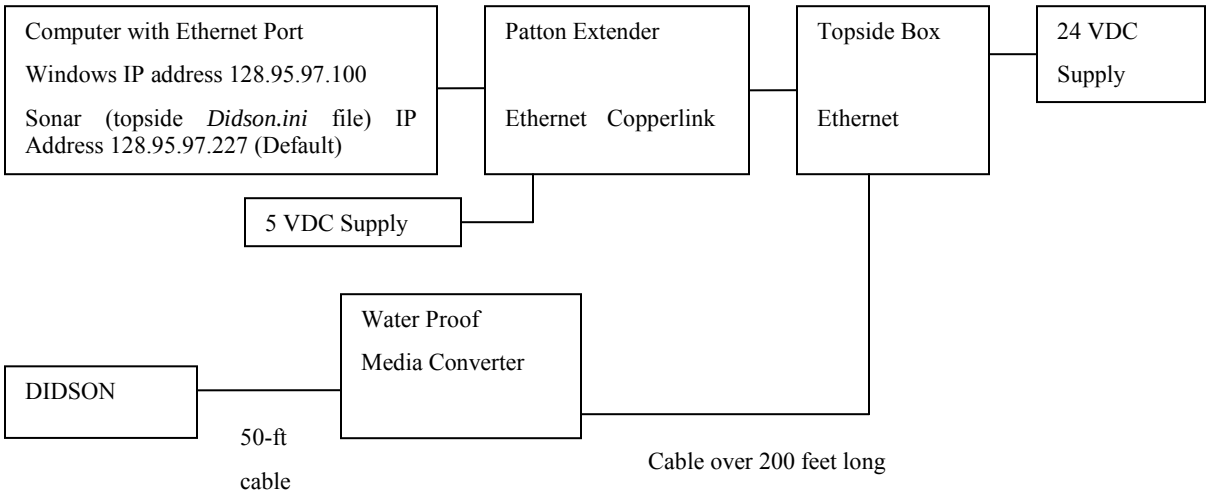
First, close the topside application. Wait 10 seconds while the focus motor automatically retracts its shaft. Then switch off the power on the topside box. That's it.

Hook-up Diagrams: May 15, 2004

Hook-up for Black Sonar Cables up to 200 feet long



Hook-up for Black Sonar Cables greater than 200 feet long (500-ft reels)



Appendix A7.–Drift Sheets

NUSHAGAK SONAR DRIFT GILLNET DATA SHEET (10 Fathom Net)

Date:	Session #: 1 2 3	Drift No:
Operator:	Mesh Size: 4.5" 5.125" 6.0" 8.125"	
Location: 1 - LBI 2 - LBQ 3 - RBI 4 - RBQ		
Time Net Start Out: 00:00 Min:Sec	Time Net Start In: : Min:Sec	

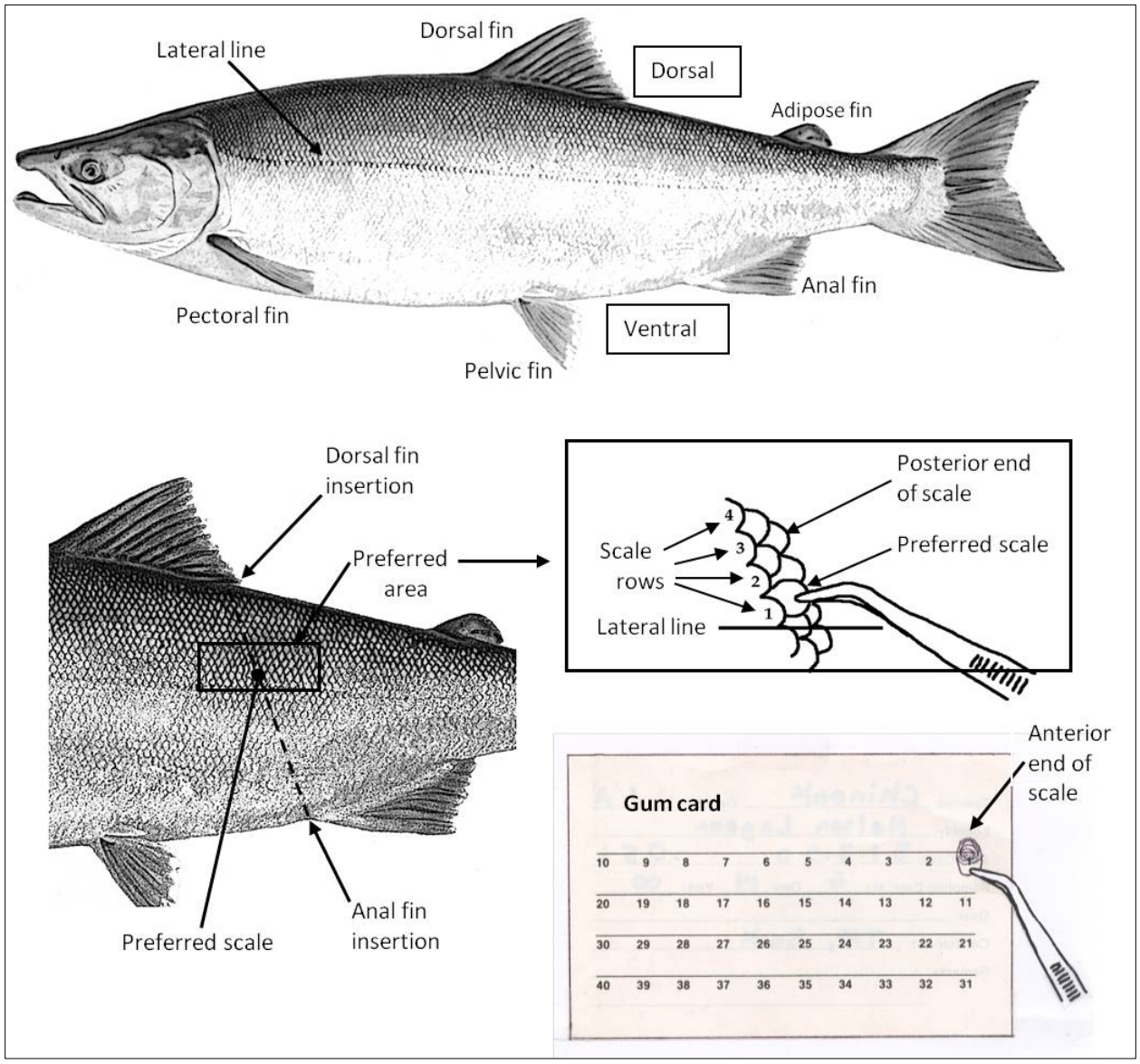
Sex Length	CHINOOK (1)	SOCKEYE (2)	COHO (3)	PINK (4)	CHUM (5)	OTHER

NUSHAGAK SONAR DRIFT GILLNET DATA SHEET (10 Fathom Net)

Date:	Session #: 1 2 3	Drift No:
Operator:	Mesh Size: 4.5" 5.125" 6.0" 8.125"	
Location: 1 - LBI 2 - LBQ 3 - RBI 4 - RBQ		
Time Net Start Out: 00:00 Min:Sec	Time Net Start In: : Min:Sec	

Sex Length	CHINOOK (1)	SOCKEYE (2)	COHO (3)	PINK (4)	CHUM (5)	OTHER

Appendix A8. Preferred scale sampling area on an adult salmon.

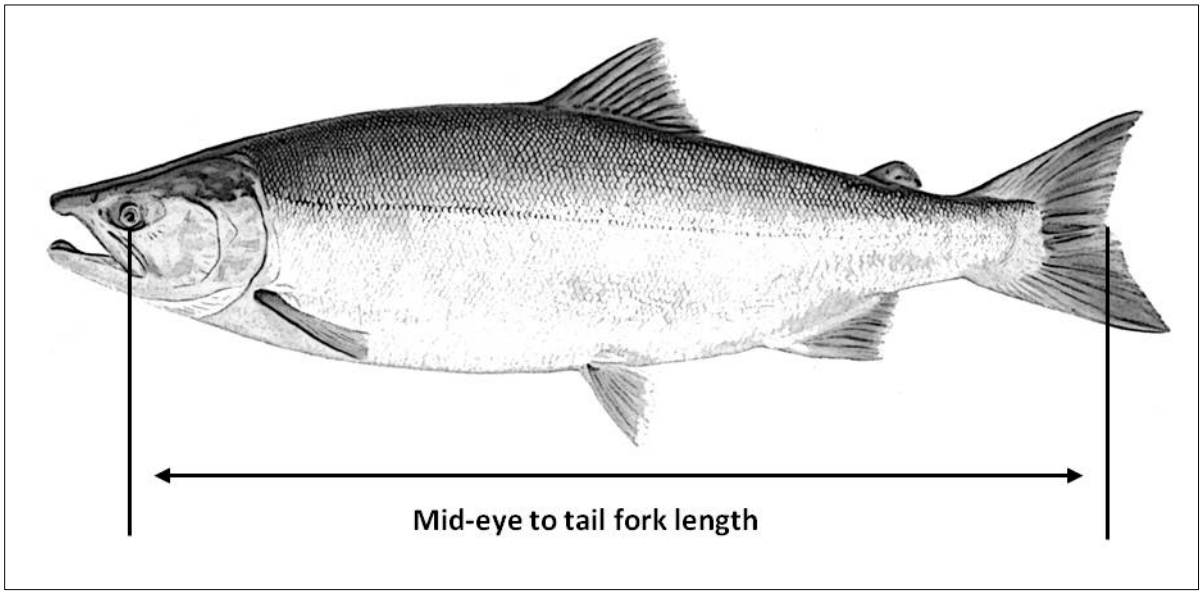


Do not turn scale over (ridged side should face up, as on fish). Place scales directly over the number on the gum card. Mount scale with anterior portion of scale oriented toward the top of the card, posterior end toward the bottom.

Appendix A9.–Measuring length of an adult salmon.

The procedure for measuring mid-eye to fork of tail length is as follows:

1. Place the salmon flat, right side down, on a board that has a ruler mounted on it with a metric scale. Orient the salmon with its head on your right, the tail in your left hand, and the salmon's dorsal surface (back) towards you. This puts the salmon in the correct orientation to remove the preferred scale from the fish's left side if the scaler is standing on the other side of the measuring board.
2. Line the eye of the salmon up with the end of the ruler, hold the salmon's head with your right hand. Gently sliding your thumb into the salmon's mouth and grasping the lower jaw works well for larger fish.
3. Flatten and spread the tail against the board with your left hand. Read the mid-eye to tail fork length to the nearest 5 millimeter and record sex and length on ASL form.



Appendix A10. Sonar logbook

(Front)

Date (MM/DD/YYYY)	***Sonar Operational Log***	This log is designed to record the daily operational parameters and performance of the DIDSON sonar and related equipment.
_		DIDSON operating parameters (indicate changes)

Watch standers:

Morning _____

Mid-Day _____

Evening _____

Compass _____

Tilt _____

Roll _____

Voltage [1] _____

Temp _____

1: Record voltage at generator start-up

Was DIDSON moved during the day? If yes, give time, new GPS, tilt and distance from shore reference point and distance from river bottom to bottom of transducer.

_____

_____

_____

Was DIDSON inoperational at any point this day? If so, indicate time range and describe how situation came about and steps taken to resolve it.

_____

_____

_____

Environmental Conditions

	AM (08:00)	**PM (20:00)**
Sky (% overcast)		
Wind Dir. (deg)		
Wind Speed (kt)		
Air Temp (deg)		
Water Temp (deg)		

River color (mark one)

Clear

Lt Brown

Brown

Dk Brown

Daily Precipitation _____

record precipitation in inches ('Tr' for trace amount).

Note that if water temp is more than 3deg different from DIDSON settings, sound speed needs to be adjusted (see DIDSON operational manual).

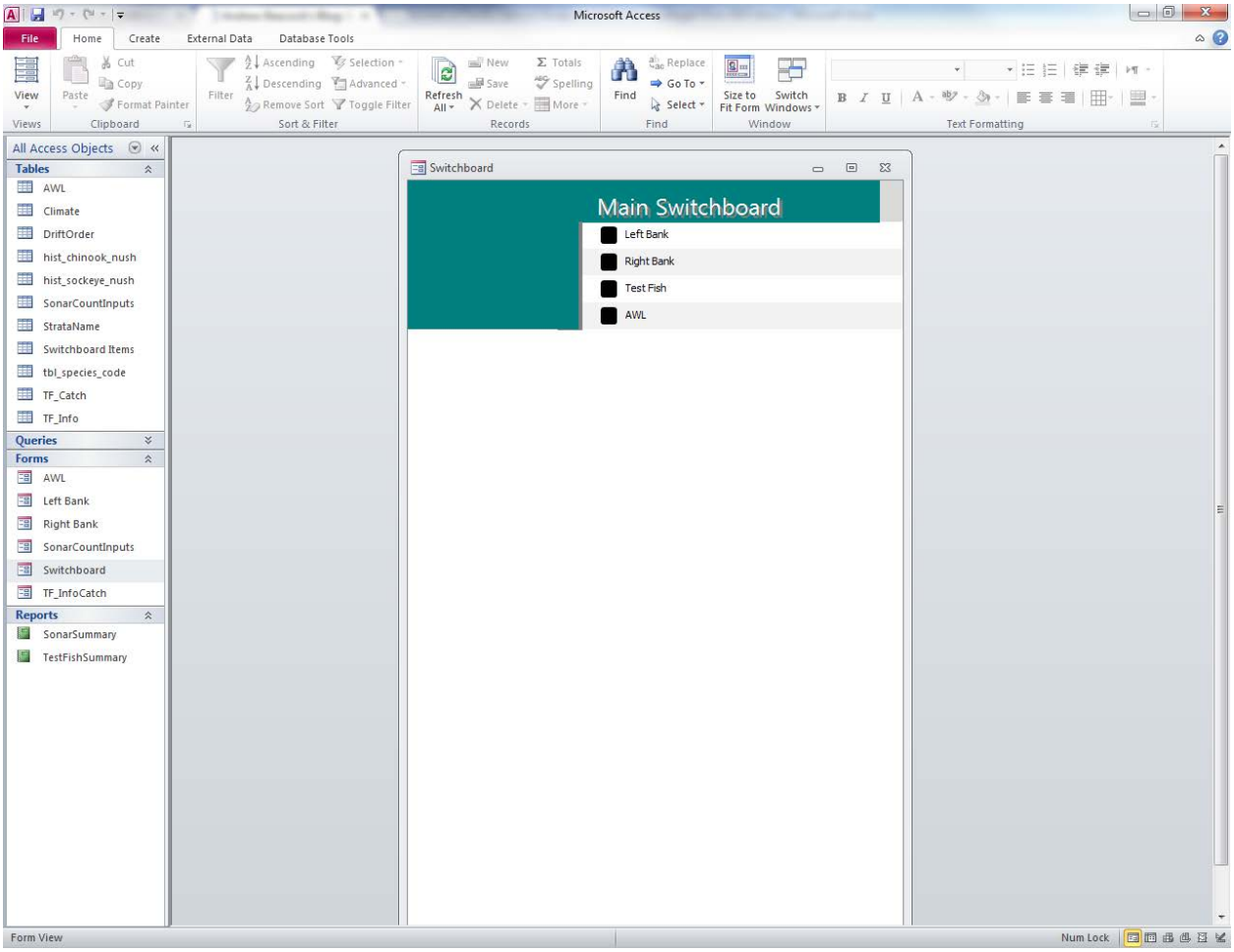
Notes:

(Back)

Date (MM/DD/YYYY)	***Sonar Count Log***				Record file length (time) and whether or not the the count recorded represents a 'True' or interpolated count and whether or not the count has been entered into the database.		
	Nearshore		**Offshore**				
Hour	Upstream	Downstream	Upstream	Downstream	Time	TRUE	Entered
0:00							
1:00							
2:00							
3:00							
4:00							
5:00							
6:00							
7:00							
8:00							
9:00							
10:00							
11:00							
12:00							
13:00							
14:00							
15:00							
16:00							
17:00							
18:00							
19:00							
20:00							
21:00							
22:00							
23:00							

Appendix A11. Nushagak River Sonar Project Database Instructions

All data related to the Nushagak sonar project is stored in an ACCESS database. Sonar technician duties can be performed using only forms and reports contained in that database. Technicians should avoid attempting to use tables and queries directly and should use the switchboard that opens on starting the database to open the desired form to enter data into the database.



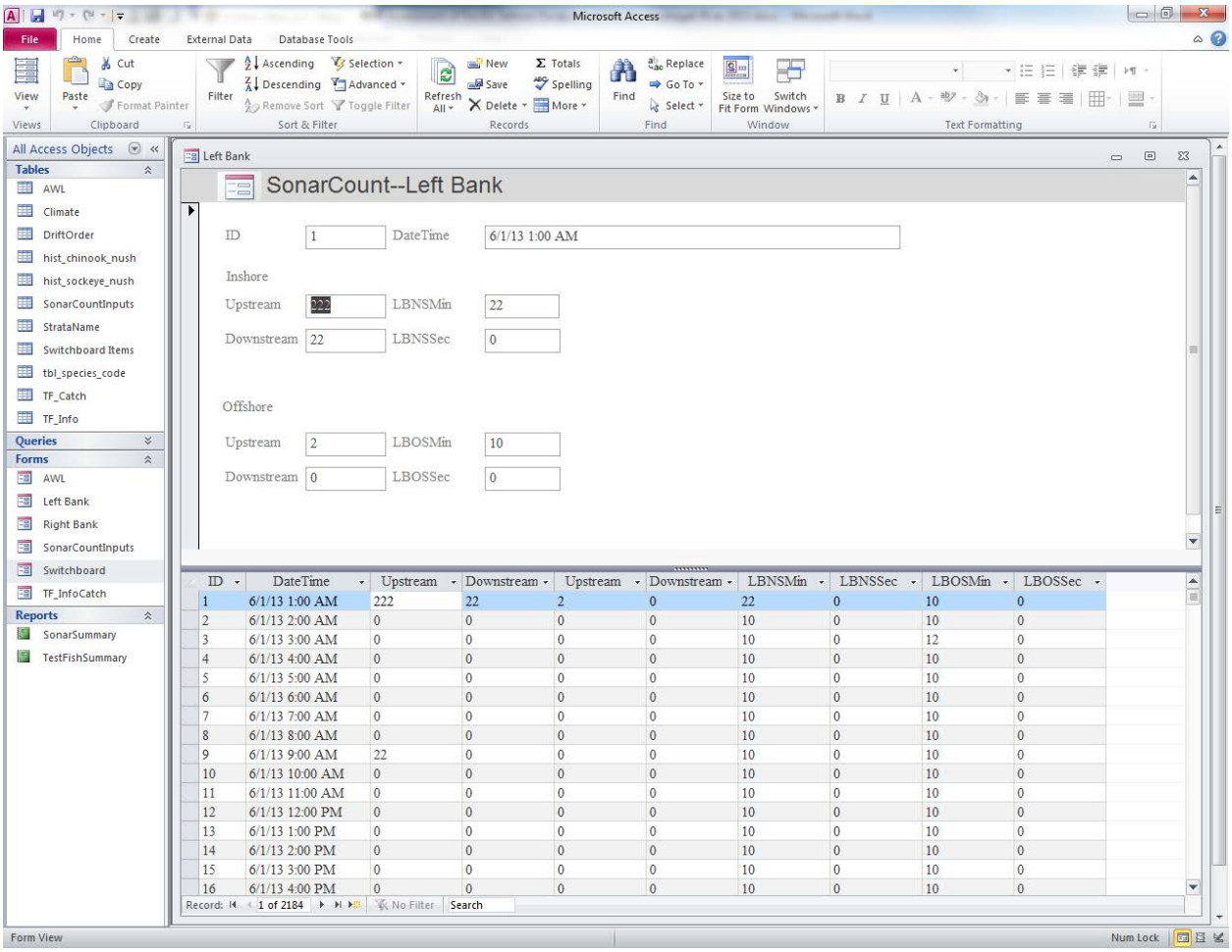
Forms are used to input data into the database (tables). Information entered on a form is automatically saved in the underlying table. Four data entry forms are used:

1. Left Bank – Used to enter left bank sonar counts
2. Right Bank – Used to enter right bank sonar counts
3. Test Fish – Used to enter test fish (total catch by species/drift) information
4. AWL – Used to enter AWL information (fish species, card, position, sex and length)

Sonar Counts

The sonar counts are entered on the bank appropriate form. This form is preloaded with a record for each hour of each day during June and July (1440 records). This is a split form which shows the underlying table on the bottom and an individual record in the top half. It is best used by

selecting the record you want to add data to on the bottom half and entering data on the top half. The tab key will scroll through the count fields. Minute field defaults to 10 and the second field defaults to 0. Users can change if non-standard file lengths were used. The right bank form and left bank form operate identically.

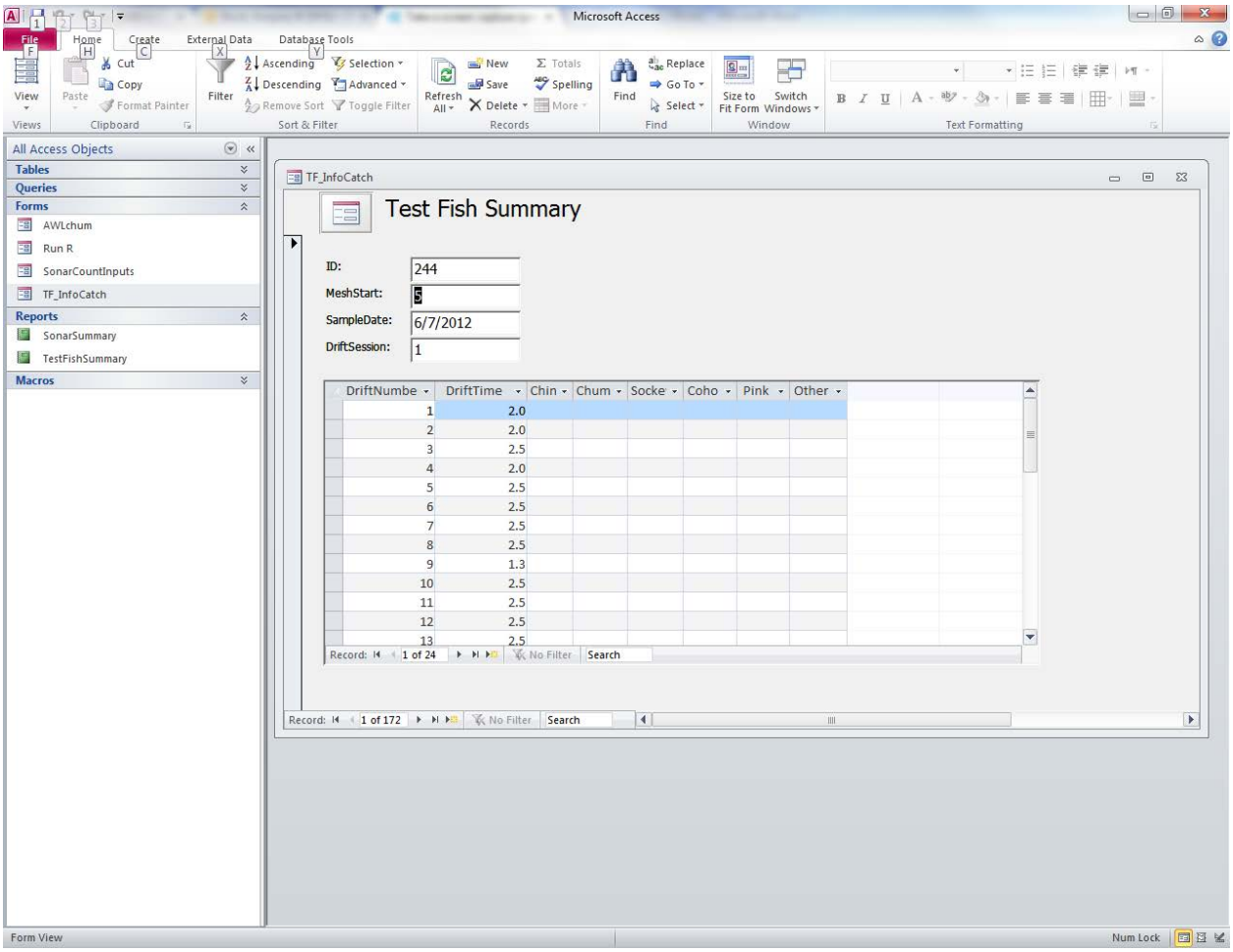


ID	DateTime	Upstream	Downstream	Upstream	Downstream	LBNSMin	LBNSSec	LBOSMin	LBOSSec
1	6/1/13 1:00 AM	222	22	2	0	22	0	10	0
2	6/1/13 2:00 AM	0	0	0	0	10	0	10	0
3	6/1/13 3:00 AM	0	0	0	0	10	0	12	0
4	6/1/13 4:00 AM	0	0	0	0	10	0	10	0
5	6/1/13 5:00 AM	0	0	0	0	10	0	10	0
6	6/1/13 6:00 AM	0	0	0	0	10	0	10	0
7	6/1/13 7:00 AM	0	0	0	0	10	0	10	0
8	6/1/13 8:00 AM	0	0	0	0	10	0	10	0
9	6/1/13 9:00 AM	22	0	0	0	10	0	10	0
10	6/1/13 10:00 AM	0	0	0	0	10	0	10	0
11	6/1/13 11:00 AM	0	0	0	0	10	0	10	0
12	6/1/13 12:00 PM	0	0	0	0	10	0	10	0
13	6/1/13 1:00 PM	0	0	0	0	10	0	10	0
14	6/1/13 2:00 PM	0	0	0	0	10	0	10	0
15	6/1/13 3:00 PM	0	0	0	0	10	0	10	0
16	6/1/13 4:00 PM	0	0	0	0	10	0	10	0

Record: 1 of 2184 No Filter Search

Test Fishing

Test fishing data is recorded using drift sheets in the boat and the total species count by drift and drift time is entered into the database using the database form shown below:



Climate

Weather data is not entered in the database but recorded in the appropriate logbook:

Running R

Species apportionment and some reporting functions are handled using scripts written in the statistical programming language R. Once all data has been entered into the database, close access and open R from the launch icon on the desktop. When R opens a large 'Rconsole' with a blinking cursor should appear. To execute an R script type *source("file")* where 'file' is the script name in the console. R scripts are stored in the 'My Documents' folder. The R scripts available are:

NushSonarApportionment.r---This code will apply a species apportionment to all sonar counts present. Therefore if the script is run on the morning of the current day with some of the days sonar counts input (for example, through 0800), it will apportion all data. Only species counts from the previous day are reported. The code will automatically display the species daily and cumulative total for each day where sonar data is present. Note that the on-screen reports show numbers rounded to nearest fish and so daily and cumulative totals may appear 'off' slightly. Strata that do not have sufficient test fish in a given day (5) are pooled with subsequent days until the requisite sample size is established. In the interim, those strata will be estimated using either historical catch per unit effort (CPUE) with CPUE from previous reporting periods. The

onscreen report shows how many strata are estimated. Until zero strata are estimated for a given day, the numbers may fluctuate as more data is added.

Results from the apportionment script are not saved automatically, only displayed on the screen. The 'official' (e.g. 0800) daily apportionment should be saved. Type *saveme=="yes"* to save a copy of the apportionment output here: C:/Nushagak/Database_outputs/.

NushSonarHourlyReport.txt—This code displays the daily raw sonar count (all strata) through 0600, 1000, 1400, 1800 and daily total.

Data Backup and Archiving

Each day after running the daily apportionment back up the database using Tools>Database Utilities>Back Up Database on the top toolbar. Backups should be saved to C:/Nushagak/DB_backups. Additionally, every 3 days burn an entire copy of the C:/Nushagak folder to a CD.

Appendix A12.– Additional Sonar shift Duties

AM Shift:

1. Start generator on RB by 7am, (unplug before starting let it warm up then eco throttle)
2. Start coffee please…
3. Get numbers up to 0600 hrs for Radio and check sonar (DIDSON 0:00-06:00).
4. Radio at 7:45 (peak) or 8:30 (off-peak).
5. 0800 Weather report Cloud cover, temperature, rainfall, wind, H20 temp (every 3rd day), water color. Use Weather station
6. Record Compass, tilt and roll of both DIDSON LB and RB
7. Update numbers through 10:00 for radio @ 1445
8. Help Enter session 1 drift data on computer
9. Before shift ends make sure numbers are updated through at least 11:00 and update radio sheets
10. Record voltage in logbook before generator is started.
11. Please complete a previous days AWL form.
12. Make new folders in external hard-drive, to put previous days files away (ex. June 12, 2012)
13. Try and get over to the LB to shut off generator and adjust solar panels if needed before shift ends.

PM Shift: Afternoon

Left bank:

1. Gas up generator and start if voltage is below 12.2!!!– use eco throttle and adjust solar panel
2. Record voltage in left bank logbook when back at camp.
3. If needed clean left bank weir

Right bank:

1. Fill drinking water and sink reservoir
2. Please complete a previous days AWL form.
3. Update numbers at 1400 for radio at 1445 (peak),
4. If needed, clean weir on right bank
5. Help enter session 2 drift data on computer
6. Make sure numbers are updated through 1800 and update radio sheets
7. Switch generators from right machine to left machine after 1445 radio call
8. Backup previous days data: LB and RB didson, and folder Nushagak on work computer to backup Hard-drive 2012

Night Shift:

1. Help enter session 3 drift data on computer,
2. Put away all drift cards, and press scales if dry.
3. Please complete a previous days AWL form.
4. 2000 Weather: Cloud cover, temperature, rainfall (empty), wind, H20 temp every 3 days), water color.
5. Check LB didson and make sure voltage has not dipped below 12.2, adjust solar panels for morning light and start generator if necessary.

6 Enter all counts into computer up to 2325. (off -peak update to 2200).
7 Put files away into the current days folder.
8 Run Apportionment program – (if off peak do in AM). -nushapportionment.r
9 DUMP the slop bucket!!!!
10 Gas up generators on LB for Morning person, and make sure coffee is ready to go!

Appendix A 13.–AWL Logbook.

Date: _____ Start Net: _____

Drift Session: _____

Sockeye

Drift #	Card #	Fish #	Sex	Length

Chum

Drift #	Card #	Fish #	Sex	Length

Chinook (Coho)

Drift #	Card #	Fish #	Sex	Length

Appendix B1.–General equipment, camp maintenance, and camp policy.

EQUIPMENT MAINTENANCE

Equipment maintenance is one of the most important operations performed during the field season. The outboard motors, generators, and other equipment must be kept in good operating condition.

It will be the crew leader's responsibility to see that all equipment is kept in good operating condition.

ENGINE CARE AND OUTBOARD OPERATION

If outboard uses mixed fuel, the correct outboard motor fuel mixture is 50:1. The newer Precision Blend outboards mix the 2-cycle oil and gas automatically, but older engines will need to have their fuels pre-mixed. Always pour the oil into the tank first, then add 2 or 3 gallons of gas and mix thoroughly, then fill tank to capacity always using a large funnel and filter. Some outboards may be 4-stroke engines, which need to have oil level checked routinely. Always mix fuel tanks or equipment under cover to prevent water contamination and always use a funnel and filter. Note that some chainsaws have a fuel mixture of 25:1, but some newer models (e.g., Stihls) use a 50:1 mix. Chainsaw gas should be mixed in a separate can and clearly marked that it is chainsaw fuel to avoid accidentally being used in outboards.

Always place outboard motors in neutral when starting and always make sure a safety line is attached between the boat and motor. Perform a check daily of the clamp screws “dog ears” that hold the outboard to the transom. Also routinely check the motor for loose screws and bolts, cracks, and breaks, especially in the area of the lower unit.

In the normal operation of an outboard, a stream of water is discharged from a hole in the bottom edge of the cowling or from the back of the shaft. If this stream of water stops, the water pump may not be working and the motor should be shut off. On propeller outboards, the side plate over the water intake can be removed for cleaning as it may be plugged. If the pump continues not to function, the outboard should not be run, and a report to base camp should be made. On jet units, a cover on the side of the cylinder head through which water circulates can be removed and cleaned, and the cover over the temperature sensor (thermostat) can also be cleaned to restore flow. Take along a piece of bailing wire to dislodge sand from the small water discharge tube under the cowling.

Check the gear oil in the lower unit of the outboard once a week and drain and replace the gear oil at the end of the season and every 50 hours of operation. Jet units must be greased daily. This is crucial. Grease guns will be provided.

If the prop, skeg or jet unit hits bottom, check the screws to make sure they are still secure and there is no damage to the lower unit. Also, remove any rocks stuck between the grates on the jet unit.

All outboards are to be tilted in the up position when moored to preclude silt accumulation in the jet unit or water pump and skeg or housing damage.

If your outboard will not start, check the following:

- Check to make sure the kill switch is clipped to the engine properly.
- Check to see if the fuel line is connected properly to the motor and the tank and not pinched or kinked, and that the air vent on the tank is open.
- Check to see if there is water in the gasoline.
- If the engine is flooded, wait 5 minutes for the plugs to dry before attempting to start again.
- Check the spark plugs and spark plug wires as they may be fouled or defective (replace if needed).

BOATS

Boats are to be kept clean and free of loose tools and debris, and moored at locations where they are not subject to damage by other traffic or through contact with the river bottom in rock laden areas. Boats must be bailed regularly of rainwater to keep them from sinking.

Further responsibility includes maintaining a bow line on each assigned craft and ensuring that each boat is properly moored at the end of each work day to preclude possible loss or damage.

GENERATORS

Portable generators may be supplied to field camps. Their maintenance is important. Since most of the generators have 4-cycle engines, mixed gas must not be used. The crankcase oil reservoir should be checked daily and maintained at the full level. At the end of the season, and after 25 hours of operation, the oil should be changed. Spark plugs should be checked at every oil change for fouling and gap.

CAMP MAINTENANCE

Keep the cabin, surrounding area, and yourself clean and neat. Appearance is important. You will not always be notified of the intended arrival of visitors, officials, etc. Visitor impressions are often based on your appearance.

Maintaining a clean and efficient field camp is required. Maintenance of living accommodations and other installations will be performed as necessary. All materials necessary will be provided.

Grounds will be kept free of litter. All garbage will be burned or bagged up and disposed of in town. Special precautions should be observed to ensure that garbage does not attract bears and other scavenger species. Dirty dishes should be washed daily and kept inside the cabin, not left in the yard or outdoors where it will attract bears.

Upon completion of the summer season, all camp equipment will be cleaned prior to winter storage. All sampling nets, tarps and life jackets must be dry before being stored. All skiffs will be brought back to the ADF&G compound.

The crew leader at the close of the field season will take a complete equipment inventory. A report detailing the equipment and storage locations will be submitted at the end of the season to the supervisor. A list of equipment needing replacement or repair will also be submitted, along with an equipment need list for next season.

CAMP POLICY

No alcoholic beverages are to be stored in areas open to public view. If alcohol is consumed at a camp an employee must be of legal age and off duty and under no circumstances shall he or she engage in the operation of any State equipment or firearms. Employees will not return to duty status under the influence of alcohol.

The crew leader of each camp shall establish a policy on living standards and personnel behavior in accordance with State guidelines. Time off for individual crew members must be scheduled by the supervisor. All employees will be required to act in a professional manner at all times and shall be especially courteous to the public.

It will be the responsibility of the crew leader to prevent any abuse of State equipment. The crew leader will report within 24 hours to the supervisor any damaged or lost equipment.

FOOD ORDERS

ADF&G will provide all food and non-alcoholic beverages while working in the field. Groceries will be purchased by either the field crew when in town or by available office personnel. It is useful to keep an on-going grocery list so you know what is needed or not needed since fridge and freezer space is limited.

COMMUNICATION

Two phones are available in camp. One is a 'bettors' phone and is a relay phone that operates in a normal manner. It should be used for routine matters as it is cheaper to operate. The 'track' phone is a satellite phone that is primarily used to communicate data with Dillingham.

Scheduled calls are used to pass on pertinent information to/from the field offices. It is expected that all employees will participate in these schedules to get familiar with the procedure. The morning schedule is used for relaying the daily species count and high priority business only as the Dillingham office personnel attempt to get counts from all field camps at the same time. Keep the conversations short so we do not hold up others using the same channel. The bettors phone may be used for personal calls using a calling card. The track phone is not to be used for personal use without permission and all personal calls must be logged.

Any employees performing job duties away from the field camp (such as boating trips up/downriver) or hiking/sport fishing/etc. on their own time are required to let others know their plans such as where they are going and when they are expected to return. Also, in each camp is a handheld VHF radio (with spare batteries), backpack with basic survival gear, and firearms and ammunition which the employee is encouraged to carry for their own safety. All employees should be aware of the gear in the camp and should request additional safety/survival items if needed or missing. Employees with any questions or concerns are asked to pass them on to their supervisor.

FIREARMS

A State firearm will be provided at this field camp. If you are unfamiliar with the operation and use of a firearm, please let your supervisor or the crew leader know. Training will be provided for anyone who requests it or is unfamiliar with firearms. Loaded guns are prohibited inside the camp facilities. Anyone handling a firearm should always treat it as if it were loaded. Guns should be kept clean and oiled daily if used and at the end of the project. Any horseplay or misuse of firearms while working for the Department of Fish and Game will not be tolerated and may be grounds for immediate dismissal. Completely unload a firearm of all rounds before cleaning or transporting back to town.

BEARS

Do not encourage bears to come around camp by leaving food or unburned garbage around. Do not shoot at a bear unless, in your best judgment, it is endangering someone's life or damaging personal or state property. Use your best judgment on whether to shoot a bear if property is at stake. When trying to frighten a bear away by shooting, do not fire toward it. You may wound it by pulling the shot, ricochets, etc. Do not use cracker shells at close distance (<30'). If a cracker shell hits a bear at close range, it may penetrate the body cavity and explode inside the bear, killing it.

GARBAGE

Burn garbage as needed, and box up any non-burnable trash to haul back to town. Be sure all burn barrels have proper grates or covers to prevent grass fires from sparks. Never leave a fire unattended and always have adequate fire extinguishing materials handy. Food that is discarded should be contained in a "slop bucket" inside the cabin. As needed, the bucket can be then be dumped into the river downstream of the weir. This should be done in the evenings when there are no sport fishermen down river.

FISH AND WILDLIFE VIOLATIONS

This is not intended as an inclusive procedure for handling violations. Below are guidelines for obtaining the necessary information and/or evidence to document a violation. It is important to be familiar with the commercial fishing, subsistence fishing, sport fishing, and hunting regulations in your area. Violation reporting procedures are printed on the back cover of the commercial fishing regulation book. Request the regulation book if your camp does not have one.

The use of the "4 Ws" can greatly aid the Fish & Wildlife Protection officer in obtaining sufficient evidence for a case.

- What is the violation?
- When did the violation occur (e.g., date, time, tide condition, etc.)?
- Where did the violation occur?
- Who is in violation and who are witnesses?

It is important that specifics about the event be documented so the appropriate officer can follow-up and contact those involved. If you have a camera available, pictures are extremely valuable in prosecuting offenders. Collect as much information as possible and contact your supervisor or a State Trooper from the Alaska Wildlife Troopers Division immediately. If you do not feel comfortable, or your personal safety may be in danger, do not pursue the violation. Contact your supervisor and they will handle the situation. Be aware that you do not have the power to arrest somebody or seize equipment. Just limit yourself to documenting the event as safely as possible.

TRANSPORTATION

Do not endanger life or property by using the skiff rough water conditions. If you are unfamiliar with running boats in marine waters and/or on rivers, it is imperative to inform the crew leader of this and proper training should occur. All personnel must wear a Coast Guard approved life jacket when out on any water. Be conservative and use good judgment: if you think it is dangerous, don't go out on the water.

A boat box equipped with all the necessary tools for the outboard should be in the boat at all times and kept as dry as possible. Necessary tools include pliers, wrenches, screw drivers, spark plugs, spark plug wrench, an extra boat plug, and baling wire. Oars and a bilge pump should also be in the boat. A life jacket is mandatory while operating the boat and handheld VHF and flares should also be carried. In case travel at night becomes necessary, carry a flashlight.

State-owned vehicles will be provided for work purposes and used **only** in the conduct of state business. Use of state-owned property for personal convenience is expressly prohibited. Individuals other than those on official state business shall not be permitted to travel in or operate state owned equipment. An official state credit card will be used to fuel up vehicles. Oil levels in the vehicles should be checked frequently. Use of state-owned vehicle, vessels, and equipment after consuming alcohol is explicitly prohibited.

FIRE AND FIRST AID

All remote employees should have up to date First Aid and CPR certificates. The Nusahgak River is considered remote, therefore; it is required for this project. Make an effort to avoid intestinal parasites such as *Giardia*. When in doubt, boil your drinking water for 15 minutes.

Check your camp's fire extinguishers. Know where it is and how to use it! Inventory your camp first aid kit, replace items as needed and become familiar with basic first aid treatment. Review the first aid booklet.

COMPATIBILITY OF FIELD PERSONNEL

If you find yourself unable to get along with your camp mate, notify your supervisor and an attempt will be made to resolve the situation.