Potential impacts of pile driving on juvenile pink (Oncorhynchus gorbuscha) and chum (O. keta) salmon behavior and distribution

Article · February 1996

Source: OAI

Blake E. Feist
Northwest Fisheries Science Center

James J, Anderson
University of Washington Seattle

AR010105

FRI-UW-9603
February 1996

FISHERIES RESEARCH INSTITUTE
SCHOOL OF FISHERIES
UNIVERSITY OF WASHINGTON
SEATTLE, WASHINGTON 98195

POTENTIAL IMPACTS OF PILE DRIVING ON JUVENILE PINK (*ONCORHYNCHUS GORBUSCHA*) AND CHUM (*O. KETA*) SALMON BEHAVIOR AND DISTRIBUTION

B.E. FEIST AND J.J. ANDERSON
UNIVERSITY OF WASHINGTON
SCHOOL OF FISHERIES

AND

R. MIYAMOTO
UNIVERSITY OF WASHINGTON
APPLIED PHYSICS LABORATORY

MAY 1992

Approved

Submitted 2-7-96

Director

CONTENTS

LIST OF FIGURES

Figure		Page

LIST OF TABLES

PREFACE

This FRI-UW report was created in order to increase awareness of a research project that was conducted in 1990. This project was focused on the impacts of pile driving noise on the behavior and spatial distribution of juvenile pink and chum salmon. A tremendous amount of work went into this research and the subsequent final report that was submitted to the project supporters in 1992. However, funding was not sufficient enough to increase distribution. The late date of this FRI-UW reflects both this situation and our desire to improve accessibility by including this report in a series that is well established and widely circulated.

ACKNOWLEDGMENTS

We thank the Washington Department of Fisheries for their support and patience during this study. We are indebted to our many crews of workers who collected data at all the sites: John Stadler and Gary Roehl—Kingston and Bremerton; Tim Dalton and Clauss Svendson—Elliott Bay; and Kevin Kumagai, Lori Christensen, and Liam Stacey—Everett Homeport. A special thanks to Michael Macauley and Mark Stoermer at the Applied Physics Lab for their always outstanding technical prowess when dealing with sophisticated passive and active hydroacoustics. This research was funded, in part, by; the Washington State Department of Transportation; Manson Construction and Engineering; General Construction; Ports of Everett, Port Townsend, Seattle, and Tacoma; Washington State Council of Carpenters; Pile Drivers Local 2396; Hurlen Construction; American Construction Company; Wyckoff Company; Black Ball; Northwest Bolt and Nut Company; Western Wood Preservers Institute; Fisher Properties Incorporated; and Fisher Mills Incorporated.

KEY WORDS

behavior, distribution, disturbance, estuarine ecology, hearing, juvenile Pacific salmon, pile driving, sound

EXECUTIVE SUMMARY

A pilot study assessed the potential effects of pile driving activities on the behavior and distributions of schools of juvenile pink (*Oncorhynchus gorbuscha*) and chum (*O. keta*) salmon. Sites studied included the Everett Homeport (near the mouth of the Snohomish River), Elliott Bay Marina (Seattle), and the Kingston and Bremerton Ferry Terminals. School size, frequency of occurrence, species distribution, and general fish behavior were measured at the sites where pile driving and fish presence coincided. Individual fish were sub-sampled for total length, weight, and stomach contents. On sampling days, tidal stage, weather, salinity, and the underwater acoustic environment were also measured.

Pile driving did not occur at the Kingston site, and juvenile Pacific salmon were not present at the Bremerton site when pile driving was in progress. Therefore, the data from these sites do not provide direct information on the impacts pile driving has on juvenile salmonids. Very few fish were observed at the Elliott Bay site, with or without pile driving.

The majority of results regarding the impacts of pile driving on juvenile salmonid ecology are from the Everett Homeport site:

❶ Within the range of salmonid hearing, the sound field generated by pile driving activities had a radius of at least
600 m.

❷ Pile driving operations apparently affected the distributions and general behavior of fish schools about the site

❸ Nearly twice as many fish schools were found on the construction side of the site on non-pile driving days compared to driving days

❹ Fish schools were typically in water <1.5 m, within 2 m from shore, and surface oriented. Fish school distances from shore did not change significantly as a result of pile driving

❺ The average total length of fish did not increase significantly over the study period, suggesting fish were either transient and/or not growing

❻ Stomach content analysis indicated that most fish were feeding

❼ While salinity and tidal stage probably affected the vertical distribution of fish in the water column, it did not appear to alter fish behavior or distribution about the construction site as measured in this study

INTRODUCTION

Pacific salmon (*Oncorhynchus* spp.) in the Northwest United States are confronted with seemingly endless challenges imposed by destruction and alteration of migration routes, and spawning and rearing habitats. Mitigation of these human induced changes often have limited efficacy. In order to avoid further impediments to Pacific salmon, the Washington Department of Fisheries (WDF) prohibits pile driving activities in Puget Sound (Washington) waters from March 15 to June 15 each year. Migrating juvenile Pacific salmon might be driven towards deeper water, have their foraging patterns altered, encounter delays in their outmigration, or be more susceptible to predation as a direct result of the disturbance created by pile driving activities.

The regulation allegedly hinders the progress of shoreline construction companies, who claim only anecdotal evidence supports the hypothesis of the WDF pile driving prohibition rule. Therefore, pile driving construction companies initiated this study in order to ascertain the impacts of their activities on the distribution and behavior of juvenile Pacific salmon. The hypothesis of WDF and this research is that sounds produced by pile driving rigs alter the abundance, behavior, distribution, and/or general ecology of juvenile pink and chum salmon at pile driving sites. To test this hypothesis, We first characterized the underwater acoustic environment at the Everett Homeport, Elliott Bay Marina, and Kingston and Bremerton Ferry Terminals, to determine if sounds in these areas were within the audible range of juvenile pink and chum salmon. Secondly, We measured the abundance, behavior, and distribution of juvenile pink and chum salmon at the four sites, with and without pile driving. The information from this study has direct application to decision making at WDF and other management agencies concerned with the welfare of aquatic organisms in the Puget Sound area. In the following section, We will review the pertinent literature on juvenile salmonid ecology in the nearshore estuarine areas, underwater acoustics, and fish audition.

ESTUARINE ECOLOGY OF JUVENILE PINK AND CHUM SALMON

Pink and chum salmon typically migrate soon after emergence from their natal streams to the estuary (see Kobayashi and Abe 1977; Healey 1979; Godin 1982). Once in the estuary, they occupy nearshore, shallow water areas until they reach a total length (TL) of 50-60 mm (Manzer 1956; Gilhousen 1962; see Kirkwood 1962; LeBrasseur and Parker 1964; Neave 1966; Kaczynski et al. 1973; Groot 1982), upon which they move into the neritic zone. Juvenile pink and chum salmon in the Puget Sound area typically migrate from their natal streams between early February and late May, with peaks of abundance occurring from late March to mid-May for pink salmon, and late March to early May for chum salmon.

Individual estuarine residence times for juvenile chum salmon vary considerably, with estimates ranging from 0 to 32 days (Mason 1974; Healey 1979; Salo et al. 1980; Chitwood 1981; Congleton et al. 1981; Simenstad and Eggers 1981; Levy and Northcote 1982; Schreffler et al. 1990). Individual residence times for pink salmon are not known.

Newly emerged juvenile pink and chum salmon occupying nearshore waters of Puget Sound have a feeding preference for epibenthic invertebrates, with a subsequent transition to more pelagic prey as they grow larger and move into deeper water (Bax et al. 1978; Simenstad and Kinney 1978; Fresh et al. 1979; Meyer et al. 1981; Weitkamp and Schadt 1982). However, there is considerable variation in the diet as a function of species, time of year, and geographical location. Kaczynski et al. (1973) found that juvenile pink salmon (mean TL 39 mm) sampled in nearshore waters of Port Susan, WA, primarily fed on barnacle nauplii, invertebrate eggs, and mysis larvae, whereas juvenile chum salmon with mean TL 43 mm, primarily fed on epibenthic harpacticoid copepods and gammarids. Feller and Kaczynski (1975) found that juvenile chum salmon with mean FL ~38 mm fed primarily on gammarid amphipods, cladocerans, and terrestrial and marine insects in the nearshore waters of Port Susan.

Pink salmon typically feed during the day, with peaks of activity occurring at dawn and dusk (Godin 1981). Juvenile pink and chum salmon grow rapidly during their occupation of the estuary. Daily growth rates range from 2.2-8.6% of body weight for chum salmon (Healey 1979; Salo et al. 1980; Bax and Whitmus 1981; Congleton et al. 1981; Irie 1985; Koshiishi 1986), and 3.1-7.1% for pink salmon (LeBrasseur and Parker 1964; Phillips and Barraclough 1978; Mortensen et al. 1991). In order to grow at this rate, the fish must consume large amounts of prey. Juvenile pink and chum salmon are estimated to consume the equivalent of 10-16% of their body weight per day in prey biomass (LeBrasseur 1969; Parsons and LeBrasseur 1970; Godin 1981). Evacuation rates are rapid, with 50% evacuation times of 6.5 h (at 8-12°C) in 0.6 g juvenile chum salmon (Koshiishi 1980).

The significance of estuaries in the lifecycle of Pacific salmon is well documented. In particular, the first few weeks in the estuary is a critical time for juveniles (Manzer and Shepard 1962; Simenstad et al. 1982; Levings et al. 1989), during which there is high mortality (Godfrey 1958; Ricker 1962; Foerster 1968; Parker 1968; Ricker 1976; Peterman 1982; Bax 1983). There is evidence that mortality of small fish is size dependent, and rapid growth and increase in body size may reduce predation pressure on juvenile salmonids during their first few weeks in the estuary (Parker 1971; Healey 1982a; Hargreaves and LeBrasseur 1985; Furnell and Brett 1986). Juvenile pink and chum salmon are especially susceptible to predation and environmental stresses since they enter the estuary at a small size immediately or shortly after emergence. They are generally smaller than juvenile coho and chinook salmon and reside in the sublittoral zone for 4 to 24 weeks before moving out to the neritic zone (Simenstad et al. 1982).

The Everett Harbor and the Port Gardner vicinity are important rearing areas for juvenile salmonids migrating from the Snohomish River (Tyler 1963; Conley 1977; McEntee 1985; Schadt and Weitkamp 1985; Beauchamp 1986; Beauchamp et al. 1987). If these fish were forced out into the neritic zone prematurely, they might be subject to increased predation pressure and decreased food availability.

Like all Pacific salmon migrating from their natal streams to the sea, juvenile pink and chum salmon migrating from the Snohomish River face stress imposed by osmoregulatory challenges. They must acclimate to salinities of 25‰, and these salinities vary from 8-25‰ at the Homeport as a function of tidal stage. However, the osmotic challenge imposed by salinities of 25‰ is apparently brief, since juvenile chum salmon become sea water adapted in 12 h (Iwata and Komatsu 1984; Hasegawa et al. 1987).

CHARACTERISTICS OF SOUND IN WATER

There are two components to sound propagation through water: particle displacement and sound pressure. Particle displacement is the to-and-fro movement (on the order of nanometers) of water molecules and is a vector quantity, whereas sound pressure is the oscillatory change in pressure above and below hydrostatic pressure and is a scalar quantity acting in all directions.

In a free sound field without physical obstructions to sound transmission, and with an advancing wavefront that is essentially a plane surface, particle velocity (the first derivative of particle displacement) is proportional to sound pressure in the following manner:

$$v = p/\rho c$$

where v = particle velocity,
p = sound pressure,
ρ = the density of the medium, and
c = the propagation velocity.

The product ρc is the acoustic impedance of the medium. However, sound levels are not usually expressed as particle velocity, rather the logarithmic decibel (dB) scale of sound pressure level (SPL) is used because a great range of sound levels are found in nature:

$$\text{sound pressure level (SPL)} = 20\log_{10} p/p_{ref} \text{ dB}$$

where p = measured sound pressure, and
p_{ref} = reference pressure.

A reference quantity is always associated with the dB in order to place sound levels in a reasonable range. Twenty µPascal (µPa) of sound pressure is the reference (re:) pressure for the dB scale in humans, because 20 µPa is the average minimum sound pressure perceivable by humans. Therefore, 0 dB re: 20 µPa is the human threshold of hearing. The pain threshold in humans is about 120 dB re: 20 µPa. For each 20 dB increase in SPL, regardless of the reference pressure, the increase in actual sound pressure is tenfold. Thus, a 40 dB increase in SPL is 100 times more pressure, 60 dB is 1000 times more and so on.

Sound pressure and particle displacement are essentially the same at substantial distances from the source. However, within a distance of l/2p (l = wavelength), from the sound source the wavefront is spherical rather than a plane surface, and particle velocity is much higher for a given sound pressure—the "near-field effect." The near-field can be thought of as the region where the greatest amount of bulk movement of water occurs in response to the sound source, which is not as pronounced after l/2µ distance from the sound source. This near-field effect can extend up to 50 m from the source for low frequencies such as 5 Hz, which is perceivable by many fish.

Sound propagation through water, is a logarithmic function of distance:

$$y = a + m(\log x)$$

where a = the source-sound pressure level (y-intercept),
m = the logarithmic slope, and
x = the distance from the source.

Therefore, the rate of SPL increase close to the source is rapid compared to that far away.

SOUND PERCEPTION IN FISH

Fish hearing in general is different from that of terrestrial organisms. Most fish hear with a primitive version of the terrestrial inner ear (located in the skull of fish) and with the lateral line that runs the length of each side of the fish and is often extensively routed on the head. The inner ear and lateral line system are collectively called the acoustico-lateralis system. The lateral line system of fish is extremely sensitive to close range pressure changes. For example, by moving past stationary objects, the blind Mexican cave fish (*Anoptichthys jordani*) is capable of identifying the shape of nearby objects, presumably using its lateral line (Campenhausen et al. 1981; Weissert and Campenhausen 1981).

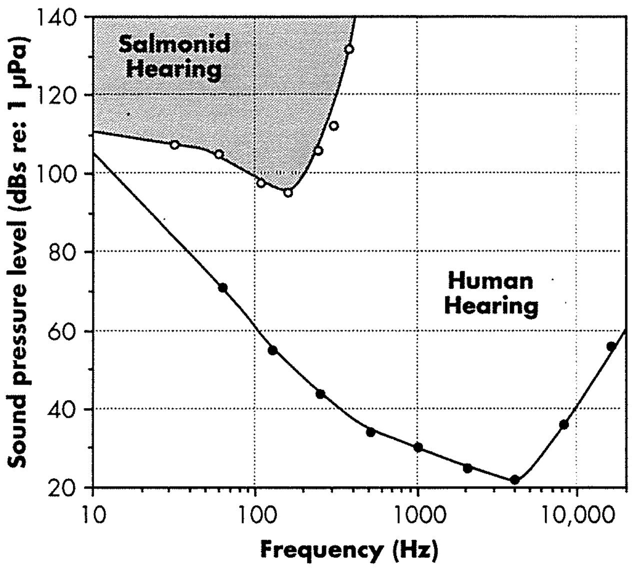


FIGURE 1. Comparison of Atlantic salmon (30-32 cm TL), *Salmo salar* (Hawkins and Johnstone 1978) and human (Sivian and White 1933 in Fay 1988) sensitivity to sound.

The inner ear of fish does not have a cochlea as in terrestrial vertebrates; rather there are three symmetrically paired structures with associated bony otoliths: the lagena, sacculus, and utriculus. The lagena and sacculus are directly involved with hearing, whereas the utriculus is mainly for three-dimensional orientation (Platt and Popper 1981). The mechanism for hearing is the differential displacement of high-density otoliths relative to the low-density bodies of fish (about the same density as water), resulting in bending of sensory hair cells that line the lagena and sacculus. This mechanical stimuli is then converted to electrical stimuli in the hair cell body and sent to the brain via the auditory nerve (8th cranial) for processing.

Audiograms or minimum audible field thresholds (threshold SPL for various frequencies) of different species of fish are variable (Tavolga and Wodinsky 1963; Chapman and Hawkins 1973; Chapman and Sand 1974; Hawkins and Johnstone 1978; Coombs and Popper 1979; Saidel and Popper 1987). Families of fish with the best hearing such as cyprinids and ictalurids (Ostariophysan fish) possess a physical connection (via a series of bones, the Weberian apparatus) between the swimbladder and the inner ear. Thus, the swimbladder acts as an amplifier and a transformer in that it transforms the sound pressure component of sound into the particle velocity component that the inner ear is sensitive to.

The hearing ability of other fish such as salmonids and flatfish is limited in bandwidth and intensity threshold compared to other teleosts: Atlantic salmon (*Salmo salar*) are functionally deaf above 380 Hz (Hawkins and Johnstone 1978, Fig. 1). These fish lack the physical connection between their swimbladder and inner ear that Ostariophysan fishes possess (Hawkins 1986). Fish with this type of hearing are most sensitive to particle velocity since the otoliths in the lagena and sacculus essentially respond to particle displacement (Hawkins and MacLennan 1976). In fact, the swimbladder probably does little to enhance hearing in most nonostariophysine fish, including salmon (Enger 1981).

Compared to humans, salmonids have poor hearing on the basis of perceivable frequency range and sensitivity to sound pressure (Fig. 1). Human infants are capable of detecting sounds from 20-20,000 Hz, and at SPLs much lower than that of salmonids. For example, a human would require about 40 dBs re: 1 µPa SPL to hear a 160 Hz pure tone, while a salmonid would require about 100 dBs. Therefore, the salmonid requires close to a thousand fold difference in SPL to hear the same 160 Hz tone.

BEHAVIOR OF FISH IN RESPONSE TO SOUND

Literature on fish hearing clearly demonstrates that fish detect and respond to sounds in their environment (see reviews in Hawkins 1986; Fay 1988; Kalmijn 1988; Rogers and Cox 1988). Fish appear to use sound: to locate prey, evidenced by attraction to a sound stimulus (for example, sharks: Wisby et al. 1964; Nelson 1965; various teleosts and elasmobranchs: Richard 1968; Nelson et al. 1969; rainbow trout, *Oncorhynchus mykiss*: Abbott 1970); for social interactions (bicolor damselfish, *Pomacentrus partitus*: Myrberg 1972; Myrberg and Riggio 1985; gudgeon, *Gobio gobio*: Ladich 1988); for encounters with fishing gear (Olsen 1971 and 1976; Nomura 1980; Wardle 1983; Ona and Toresen 1988); for encounters with hydroelectric bypass systems (Anderson 1988a and 1988b), and to signal the presence of danger, evidenced by fish avoiding a sound stimulus (steelhead trout, *O. mykiss*: VanDerwalker 1967; herring, *Clupea harengus* L.: Blaxter et al. 1981a; Schwarz and Greer 1984; Blaxter and Batty 1985a; 1985b; alewife, *Alosa pseudoharengus*: Haymes and Patrick 1986).

A number of researchers have successfully conditioned fish to sound (Moorehouse 1932; Stober

1969; Abbott 1970 and 1973; Hawkins and Johnstone 1978). While salmonids can be attracted to or repelled from sound through classical conditioning (Abbott 1973), they habituate rapidly or do not respond at all when there is no conditioned response, regardless of SPL (Burner and Moore 1962, Moore and Newman 1956). "At no time did a sound frequency or intensity influence the action of the trout enough to be utilized in guiding young salmon into safe passages around dams and diversions" (Burner and Moore 1962). An explanation for this is that salmon have poor hearing, and the nature of the sounds presented to them in experiments has not been biologically relevant.

The response of salmonids to sounds in their environment is varied. The classic fright response of salmonids to sound is the "startle" or "start" behavior (Moore and Newman 1956; Burner and Moore 1962; VanDerwalker 1967). Such behaviors involve sudden bursts of swimming that are short in duration and distance traveled (usually <60 cm). Responses of other species of fish to sound include packing or balling, polarizing, increases in swimming speed, diving, or avoidance (Herring 1968; Olsen 1969). Few studies have shown that sound can attract or repel salmonids over great distances or for long lengths of time (McKinley and Patrick 1986).

The majority of hearing experiments conducted on salmonids have involved larger juveniles or adult fish, exposed to continuous sound stimuli. Fish under these experimental conditions rarely respond to sudden or loud sound stimuli (Moore and Newman 1956; Burner and Moore 1962). However, the few experiments that have used pulsed (pile driving most closely resembles pulsed sound stimuli) rather than continuous sound stimuli on juvenile fish demonstrated more pronounced responses, such as "startle" or general avoidance (McKinley and Patrick 1986).

Few studies have investigated the behavior of fish in response to changes in SPL over time. Olsen (1971) found a positive correlation between the rate of sound pressure increase and the number of Atlantic herring that would avoid this stimulus (see Blaxter et al. 1981a). Schwarz and Greer (1984) obtained similar results on Pacific herring (*C. harengus pallasi*). However, these studies did not quantify rates of sound pressure increase or the fish's response to the sound stimulus.

MATERIALS AND METHODS

We used slightly different methodologies at each of the four sites for this research. These differences are described for each site where applicable.

STUDY SITES

There were four sites examined for this study: The Everett Homeport, Elliott Bay Marina, and Bremerton and Kingston Ferry Terminals.

Everett Homeport

Fish behavior observations at the Everett Homeport were made from the shore of the mole and the pile driving rigs (Figs. 2 and 3) at the Everett Homeport, Everett, WA (see Driscoll 1978 for a detailed base information and evaluation study of the Snohomish Estuary). The mole area consisted primarily of rip-rap, with a slope of 30°.

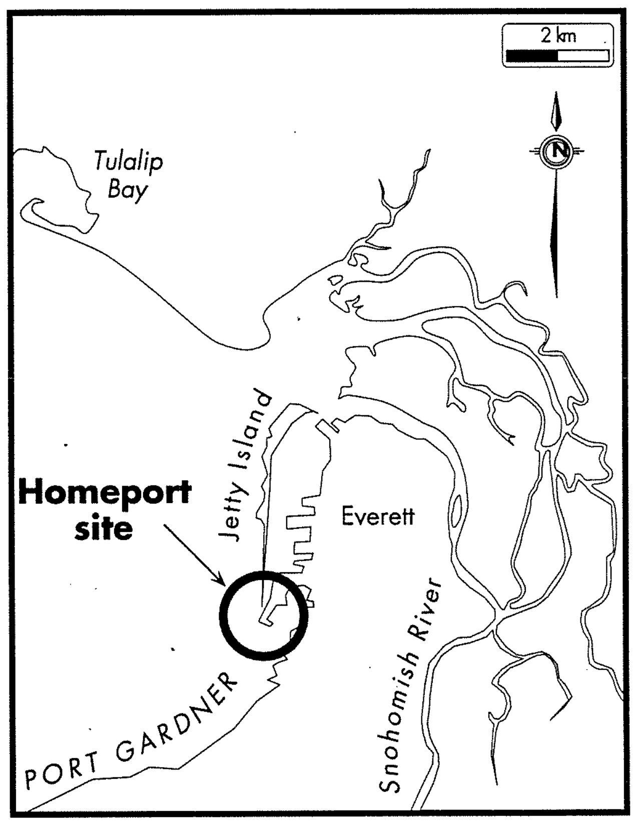


FIGURE 2. The Everett Homeport site in relation to Tulalip Bay and the Snohomish and Stillaguamish Rivers.

Pile drivers placed solid and hollow concrete piles at this site for construction of a 488 m carrier pier and its accompanying 91 m wharf. The DB Pacific rig began at the shoreline and gradually moved offshore working on the carrier pier (Fig. 3). The 60 rig moved back and forth along the shore working on the wharf. See table 1 for a summary of piles, and pile driving equipment.

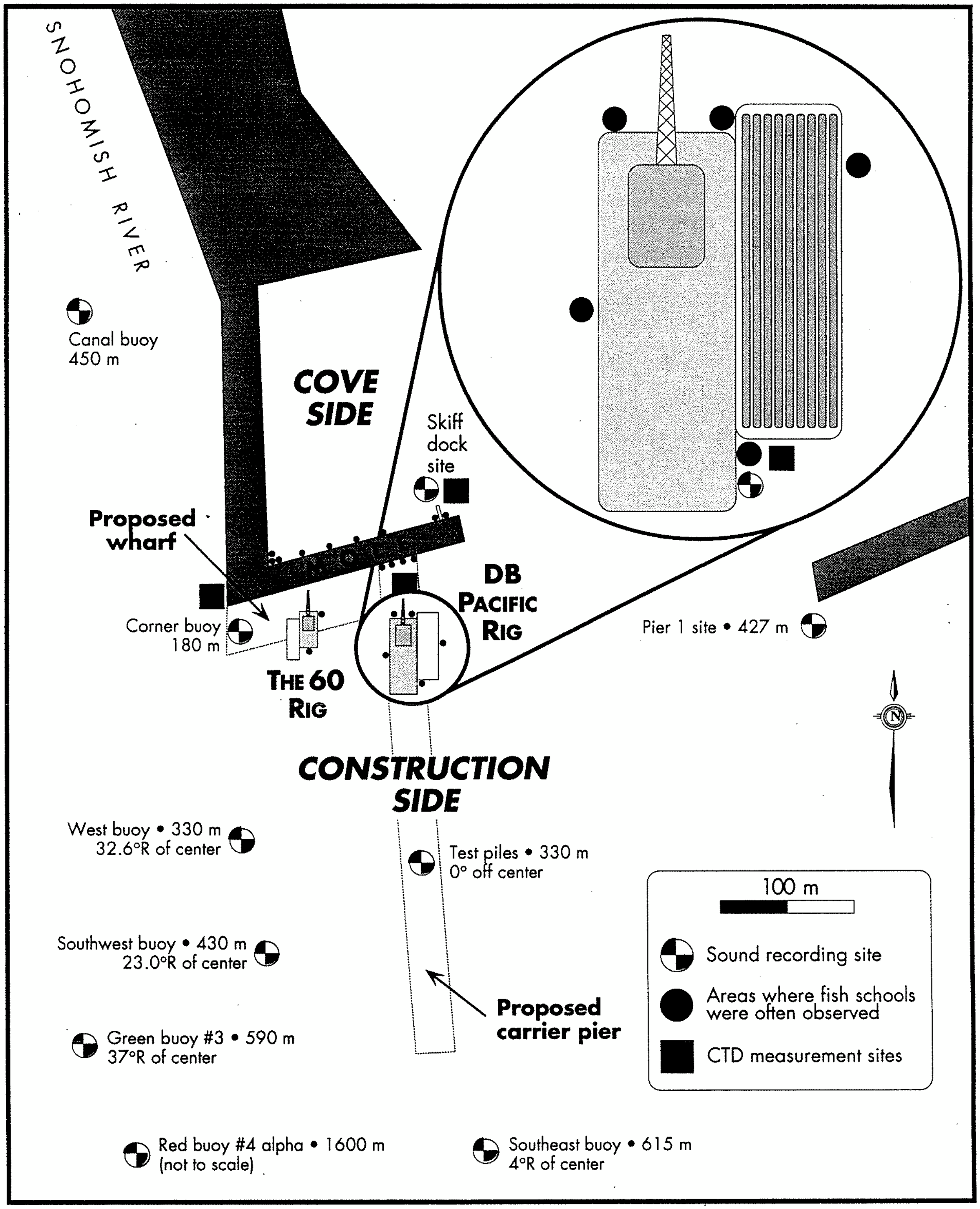


FIGURE 3. Detail of Everett Homeport site showing sound recording sites and distances, areas where fish schools were often sighted, CTD sites, and cove and construction side of the mole.

Pile driving rigs operated for 8-10 hour periods per day on a random daylight schedule (i.e. Monday, Wednesday, Friday pile driving, Tuesday, Thursday non-pile driving, etc., see Fig. 4). Observations were made during daylight hours only. There was no construction activity or observations on weekends.

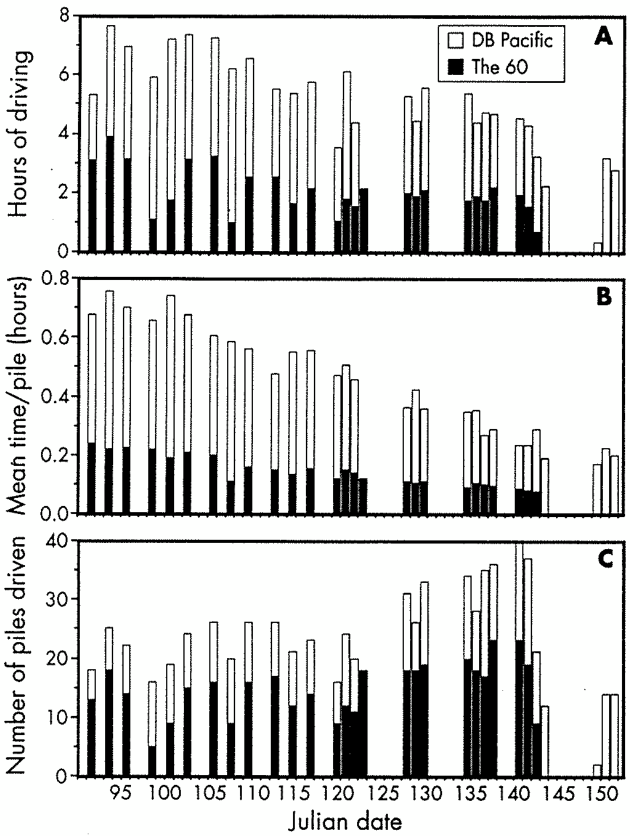


FIGURE 4. Summary of pile driving at the Everett Homeport, 1990. A] Hours per day that piles were being struck. B] Mean time in hours to drive one pile. C] Total number of piles driven each day.

Elliott Bay Marina

The Elliott Bay Marina construction site is located west of Pier 91 in Elliott Bay, below the eastern end of the Magnolia Bluff (Fig. 5). The study site was divided into four experimental units (Fig. 6):

Unit 1: A shallow sloping intertidal beach east of the marina site. The bottom was composed of sand intermixed with rocky areas which included large boulders (man made as well as natural). Most rocky material was covered with barnacles and kelp of several species.

Unit 2: A rock wall recently built as part of the marina. The wall was covered with juvenile barnacles and green algae up to the average high tide. Below the wall was a gentle sloping sandy flat intermixed with kelp beds.

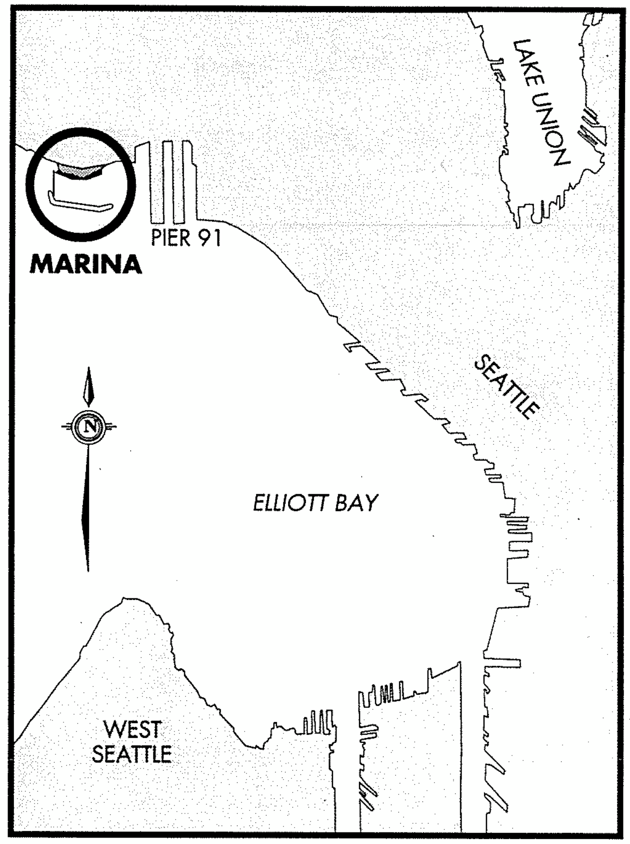


FIGURE 5. General map of Elliott Bay Marina site.

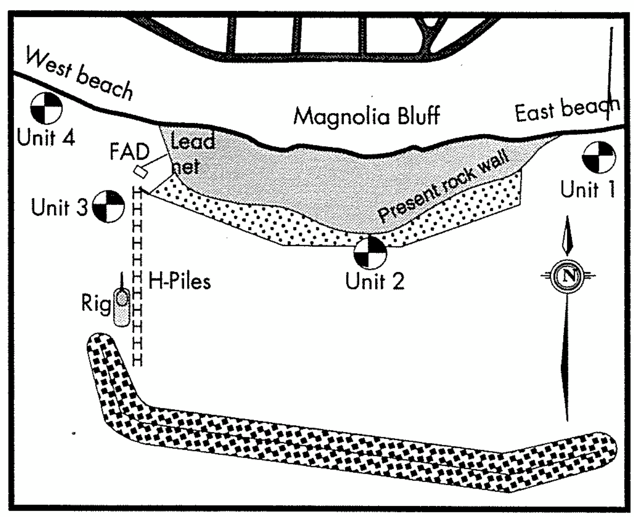


FIGURE 6. Close-up of Elliott Bay Marina site showing experimental units, FAD, and area where pile driving occurred.

Unit 3: This experimental unit was near a series of H-piles and barges. A Fish Attraction Device (FAD) was placed at the west end of the rock wall, far enough offshore to prevent going aground at low tide. The FAD was used to attract juvenile salmonids to a location where they could be consistently observed. The FAD was made of a floating wooden dock (2.4 m by 3.7 m), anchored to the bottom (Fig 3). An observation hole was located in the middle Initially, the FAD was probably placed too far from the shore to attract fish. To compensate for this, a fine mesh net was placed from the rock wall to the FAD (Fig 7), thereby forcing any juvenile salmon away from the shore and out to the FAD. The structure lasted less than 24 hours because severe winds and tides carried it ashore. The FAD was then moved closer to shore into the intertidal zone without the lead.

Unit 4: A shallow sloping intertidal beach west of the marina site composed of small rocks intermixed with large boulders. Exposed hard surfaces were covered with barnacles and several species of algae.

Sampling began on April 9, 1990 and ended June 1, 1990. During that period H-piles were driven with a vibratory hammer into the nearshore substrate, starting at the zero tide line and continuing offshore (Fig. 6).

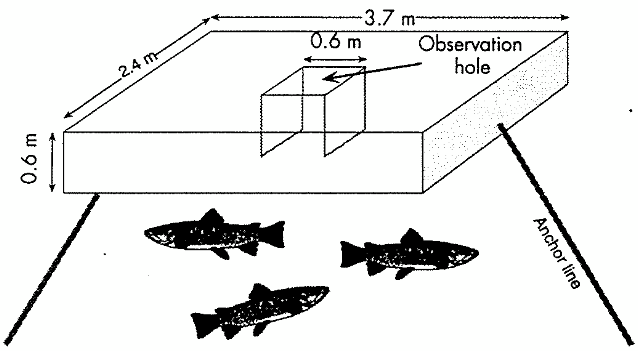


FIGURE 7. The fish attraction device (FAD).

The pile driving rig operated for 8-10 hours per day Monday through Thursday (Fig. 8). Observations were made during daylight hours only. There was no construction activity or observations on weekends.

Bremerton Ferry Terminal

The study site was the new WSDOT passenger only ferry terminal adjacent (northeast) to the existing ferry terminal used by the large WSDOT ferry boats (Fig. 9). Construction plans included the installation of a floating dock just north of the existing ferry terminal and underwater piling to anchor the dock. Most of the shoreline above zero tide level was dominated by rip-rap and boulder wall and several existing structures protruded into the water including a public pier and a public boat moorage facility.

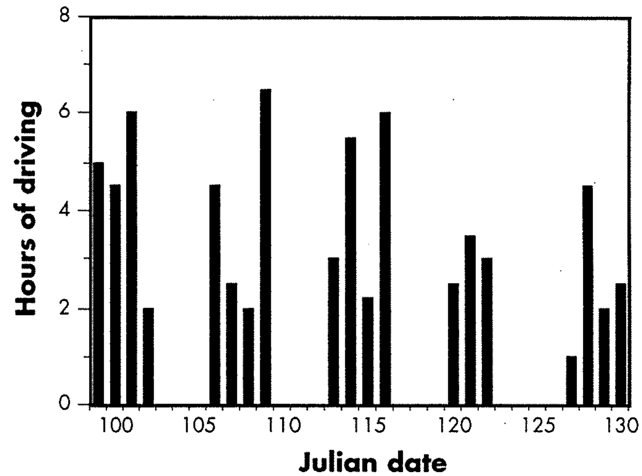


FIGURE 8. Hours per day that piles were being struck at the Elliott Bay site.

Kingston Ferry Terminal

Kingston has two waterfront structures: a marina sheltered from Puget Sound by a large rock wall, and a WSDOT ferry terminal (Fig. 10). During spring of 1990, the ferry terminal was undergoing major remodeling, but without any underwater construction activity.

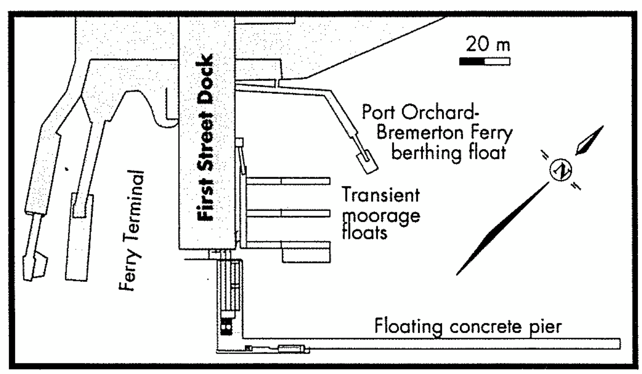


FIGURE 9. Bremerton Ferry Terminal and associated structures.

PROCEDURE

There were two phases to this study: the sound recording and hearing assessment phase and the fish observation phase. The purpose of the first phase was to assess whether or not juvenile salmonids could perceive the sounds of pile driving. Since it was difficult to determine the fish's capability to perceive the sounds of pile driving, the observer phase of the study was initiated in order to measure potential changes in fish distribution and behavior with respect to pile driving.

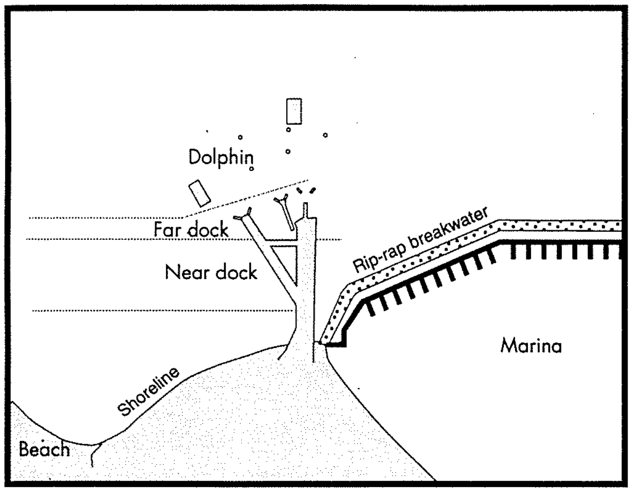


FIGURE 10. Kingston Ferry Terminal and associated structures.

Table 1. Characteristics of pile driving rigs and piles at the Everett Homeport.

Rig/Dimensions	DB Pacific/76X25 m The 60/37X13 m
Pile driver/Hammer weight	Delmag D62-22/6,625 Kg Delmag D46-32/4,600 Kg
Pile length/weight	55 m/26 mt 32 m/17 mt
Pile type	Hollow Solid

SOUND MEASUREMENT

The sounds of pile driving and ambient noise were recorded at numerous sites at the Everett Homeport (Fig. 3). At the other three sites, sound was measured at only a couple of sites, at a range of about 300-400 m, with and without pile driving

Low frequency sound from 20 to 10,000 Hz was measured at each of the four sites with and without pile driving activities at distances of 150 to 1500 m, and water depths of 1 to 20 m. An ITC model 650-C hydrophone was used to sample sound, with the transducer output gain control modified for low frequencies. Signals were recorded on a portable sound recording unit (Sony Professional Walkman®), analyzed with a Hewlett-Packard 3561 spectrum analyzer, and plotted with a Hewlett-Packard model 7470A two pen plotter.

Sound pressure level was calibrated in terms of a logarithmic measure, the decibel, relative to a reference pressure of one μPa [1 μPa $=10^{-6}$ Pa $=10^{-6}$ Nm^{-2} $=10^{-5}$ μbar $=10^{-5}$ dyne/cm^2]. SPL is expressed as:

$$SPL = 20\log_{10} p/p_{ref}$$

where p is the pressure in Pa, and p_{ref} is the reference pressure of 1 μPa. SPL was normalized to a bandwidth of 1 Hz and units expressed as dBs re: 1 μPa. Instrument output was in dBV, and was converted to dBs re: 1 μPa using:

$$\text{SPL in dBs re: } 1\ \mu\text{Pa} = \text{dBV} - \text{gain} + 157 - 10\log_{10}(\text{bandwidth})$$

where gain = a function of the recording equipment settings, in dB,
157 = the hydrophone constant in dBV/μPa, and
bandwidth = a function of the frequency range sampled, in Hz.

The analysis window was 160 ms for analyzing the transients produced by pile driving.

FISH OBSERVATION

Everett Homeport

Four observers at Everett recorded fish school characteristics. One observer was responsible for both of the rigs. The other three observers stayed along shore. The standardized unit of observation for the mole area was the round. A round consisted of walking slowly around the mole starting either at the elbow of the mole or the mouth of the Snohomish River (Fig. 3). A round typically took 60 to 90 min to complete. The relative position of fish schools were categorized into 14 zones each 36 m long with a total of 512 m of shore covered per round.

Observations on the two pile driving rigs were standardized to one hour increments. The observer would spend between one and three hours at a time on each rig. The locations of fish schools were categorized for each rig (Fig. 11).

Fish presence/absence, distributions about the mole and rigs, school size, distance from shore or rig, water depth, direction of migration, and general behavior were monitored from March 24 to June 15, 1990. Fish behavior was also recorded on a camcorder (JVC model GF-500U). Information on cloud cover, air temperature, wave height, precipitation, wind speed and direction, time of day, salinity, and tidal stage, was also noted. Salinity/temperature profiles were measured at various sites and times with a YSI (model 33) CTD meter (Fig. 3).

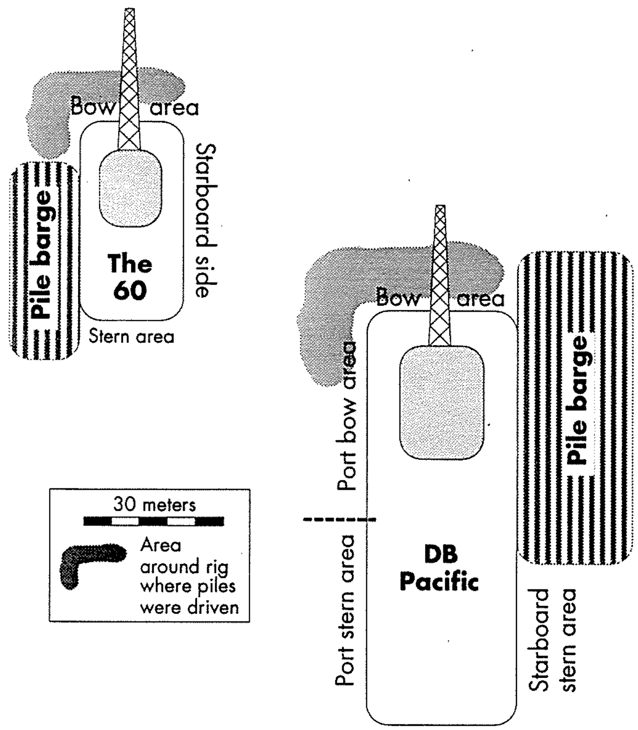


FIGURE 11. Detail of pile driving rigs (to scale) showing zones where fish schools were spotted, and the area around each rig where pile driving occurred.

Presence/absence of fish was characterized by the number of schools spotted per round of the mole or per hour on each rig, with and without pile driving. The mean number of fish schools spotted per round for Julian dates 123, 124, 127, 128, 134, and 135 was calculated. These dates were used because they had similar weather conditions, and represented back to back comparisons pile driving vs. non-pile driving. Presence/absence as a function of salinity was also determined at the skiff dock and main pier (within 3 m of shore) for Julian dates 114, 115, 136, 137, 138, 141, and 142. These dates were used because they were the only days the CTD mete was available. The mean number of schools sighted per round of the mole or hour on a rig for each day were determined in order to illustrate changes in school abundance over time.

In order to test for changes in fish school distributions on the mole, raw fish school sightings were normalized by converting into a fraction of the total observed. For example, if 15 schools were observed along the cove side and 5 along the construction side, the fraction of fish schools on the cove side to construction side was 0.75 to 0.25. Julian dates 116, 120, 121, 122, 123, 124, 127, 128, 129, 130, 134, 135, 136, and 137 were used for this analysis. These dates were chosen because it was not raining, and because this time period corresponded to the greatest number of schools present at the site.

School size was characterized as 10's, 100's, or 1000's. A comparison was made on the distributions of school size for Julian dates 116, 117, 123, 124, 127, 128, 130, 131, 134, and 135 at the cove and construction side of the site, and, on Julian dates 109, 110, 116, 117, 123, 124, 127, 128, 130, and 131 at the two rigs. Since mean fish school size was bimodal over the study period, school size data for the peak of the outmigration with back-to-back comparisons of pile driving/non-pile driving days was used. Mean school size per day was plotted in order to illustrate changes in school size over time.

Behavior was categorized as: polarized, active milling, and passive milling (Fig. 12). Polarized behavior was characterized by fast (>1 bls) swimming in one direction. Active milling was characterized by slow (<1 bls) swimming in one direction. Passive milling fish exhibited no net movement, and were diffuse. Data from Julian dates 89-143 were used.

Migration direction was categorized as north, east, west, south, or stationary/unknown. North or south movement was rarely noted along shore, and was not used for analysis. Data from Julian dates 89-143 were used.

Water depth, and distance from shore that fish schools were observed at were compared as a function of pile driving.

Elliott Bay

Direct visual observations to locate and observe juvenile salmonid behavior were conducted Monday through Friday, using a similar protocol used at the Everett Homeport. The majority of the visual observations (surveys) were taken from the construction barges and the FAD. Observation time ranged from one to two hours. Visual surveys were also conducted from a canoe along the rock wall and the H-piles in half hour periods. Wind, water turbidity, and vessel generated wave action occasionally made observations difficult.

Bremerton

Observation sites were located at the existing ferry terminal, public pier and public moorage, along the rip-rap and boulder wall to the northeast of the public pier, and from a small boat around the construction site (Fig. 9). Direct visual observations of juvenile salmonid behavior were initially conducted Monday through Friday, but because fish were such a rare sight, observations were reduced to twice a week.

Kingston

Visual observations were used to evaluate the behavior and distribution of the juvenile salmonids, adhering to the observation protocol used at the Everett

Homeport whenever possible. Observations were made from the rip-rap north of the ferry terminal, to the ferry dock complex (including occasional observations in the area of the dolphins, Fig. 10), the jetty south of the terminal, and the Kingston marina. To simplify the observations, both the rip-rap and jetty were divided into 30 m sections, each treated as an observational unit. Within the marina, observations were made from the floating dock along the inside of the jetty at a set of randomly selected slips. In addition to these slip observations, occasional observations were made from ramps leading to private docks in the remainder of the marina (docks A through E). Julian date, time of observation, weather conditions (air temperature, cloud cover, wind speed and direction, wave height), water clarity, current direction, location of observation, school size (1, 10, 100, 1000, 10,000 fish), depth of fish, direction of movement, distance from shore, distance from pile, were recorded.

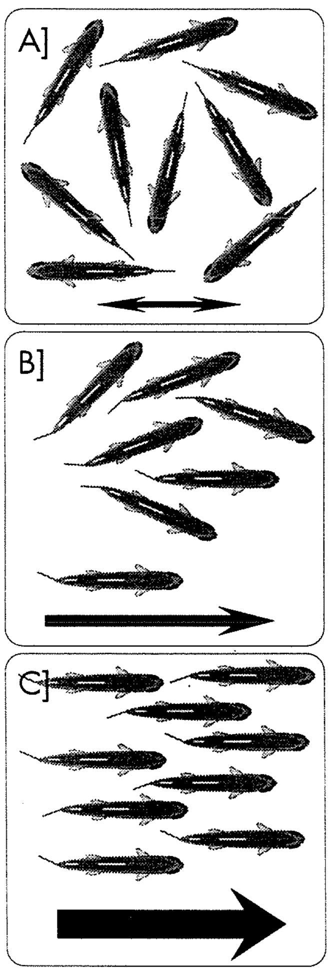


FIGURE 12. The three fish behaviors. A] Passive milling: no net movement. B] Active milling: slow net movement. C] Polarized: fast net movement.

BEACH SEINING

The beach seines used at all of the sites in this study were 10 by 1.8 m with a 4 mm mesh size.

Elliott Bay

Beach seining was performed at the east (experimental unit 1) and west (experimental unit 4) beaches each field day (Fig. 6). At each beach, 6-10 sets were made depending on the tide stage and bathymetry. The majority of the beach seining was carried out during flood tides. For any given set, one person remained stationary right at the waterline on shore, and other person pulled the net in a semi-circle around the stationary person.

Occasionally, the beach seine had to be lifted over large rocks in its path and fish possibly escaped at that time. However, 6-8 reliable samples were usually obtained at each beach.

Bremerton

Beach seining was performed at a small sandy intertidal area between the public pier and existing ferry terminal (Fig 8). Additional weekly beach seine samples were collected northeast of the rip-rap and boulder wall (Fig 1). For a typical set, the net was dragged by both persons parallel to shore for a distance of 15 to 30 m.

Kingston

A series of beach seine sets were made along the beach north of the ferry terminal (Fig. 10). This area was chosen because it afforded a location that could be seined at all tidal levels. The area closer to the dock complex could only be seined at very low tides. For any given set, the nèt was carried out from shore to a depth of 1 m. One person then walked parallel to shore, stretching the net behind them. When the net was fully extended, both persons would begin pulling the net toward shore. Once at shore, the ends of the net were pulled close together, and the seine was pulled onto the beach. Ten to 20 individuals were sub-sampled for length measurements, and the remainder were counted and released. If the number of salmonids was too large to quickly count, their numbers were estimated and they were released. All other fishes were counted and released. Weather data were recorded along with species composition of the catch. Two to four sets were made along the beach during each sampling.

FYKE NET

A specially designed fyke net was deployed at Elliott Bay, Bremerton, and Kingston to trap fish (Fig. 13). The net was designed to capture fish under varying tide conditions and also indicated the direction the fish were moving when the net intercepted them.

Elliott Bay

The fyke net was moved between each of the four experimental units during the study period, operating on a one week rotation at each unit. The net was checked every hour in order to quickly release any fish that were captured. The fyke net was never left fishing at night or over the weekends.

Bremerton

A fyke net was used temporarily at Bremerton since fish were rarely captured.

Kingston

A modified version of the standard fyke net where the top half of the net was removed was used to trap salmonids at Kingston. The net was fished from Julian dates 135 - 159. The net was located approximately 15 m north of the ferry dock complex, with the lead tied to the bulkhead of the dock. At first, the net was fished only during the day. Later, when the catch dropped off, the net was fished 24 hours/day, and was checked in the morning and afternoon. When the fyke net was checked, any fish trapped were netted, identified, counted, and released, with the exception of those salmonids retained for length measurements. If the fish in the trap were too numerous to count, their numbers were estimated. Information recorded included species counts, which side of the net they were trapped in as well as weather information.

CTD PROFILES

Everett Homeport

Salinity and temperature measurements were made at the skiff dock, carrier pier, DB Pacific, and west entrance to the site (Fig. 3). Initial profiles in 1 m increments were made, but most of the measurements were surface or 1 m.

Elliott Bay

Salinity and temperature measurements were made at the east and west beach, and wall at the surface and bottom, at o and 10 m from shore (Fig. 6).

Bremerton

CTD profiles were obtained at a few locations at Bremerton near the Ferry Terminal.

Kingston

CTD profiles were obtained twice at slip #3 of the marina floating dock, at the south floating dolphin, and at the ladder on the north side of the dock complex (Fig. 10). In addition, a profile was obtained at a location approximately 400 m off shore.

STOMACH CONTENT ANALYSIS AND FISH LENGTH AT THE EVERETT HOMEPORT

Sub-samples were taken from observed salmonid schools for total length, weight, identification, and stomach content analysis, and keyed to species according to Phillips (1977).

A regression was performed on pink and chum salmon TL over time and 95% confidence intervals generated. Fish were sampled with either a dip net from shore, or with the 10 m beach seine at the skiff dock, mole elbow, or main pier. Total length of pink and chum salmon was also compared for pooled data, since neither species exhibited a significant increase in size over time.

Fish targeted for stomach content analysis were sampled from the skiff dock and carrier pier on 5/17/90 with a dip-net (3 m from shore, 0.5-1.5 m water depth), the DB Pacific on 5/18/90 with a purse seine (115 m from shore, 18 m of water) and near Howarth Park at Port Gardner on 5/25/90 with a 33 m beach seine (0-10 m from shore, 0.5-1.5 m water depth). Captured fish were sacrificed by placing directly into 30% formalin, fixed for one week, washed in freshwater for 24 h, and transferred to 30% ethanol. Fish were blotted and weighed, measured, and identified after the washing stage. Stomach fullness, predator and prey weight, prey number and identification, and digestion stage were determined for each fish. Since stomach contents data were only collected once at these four sites, statistics other than means and SD's were not possible. The various prey items were plotted as a function of fraction of abundance by number in the stomachs of pink and chum salmon sampled. In addition, the means of number of: prey types, number of prey per stomach, predator weight, stomach fullness, prey weight, stomach weight, predator TL, predator TL to weight ratio, and stomach weight to predator weight ratio were plotted for qualitative comparisons by site and species of predator (see Appendix 2).

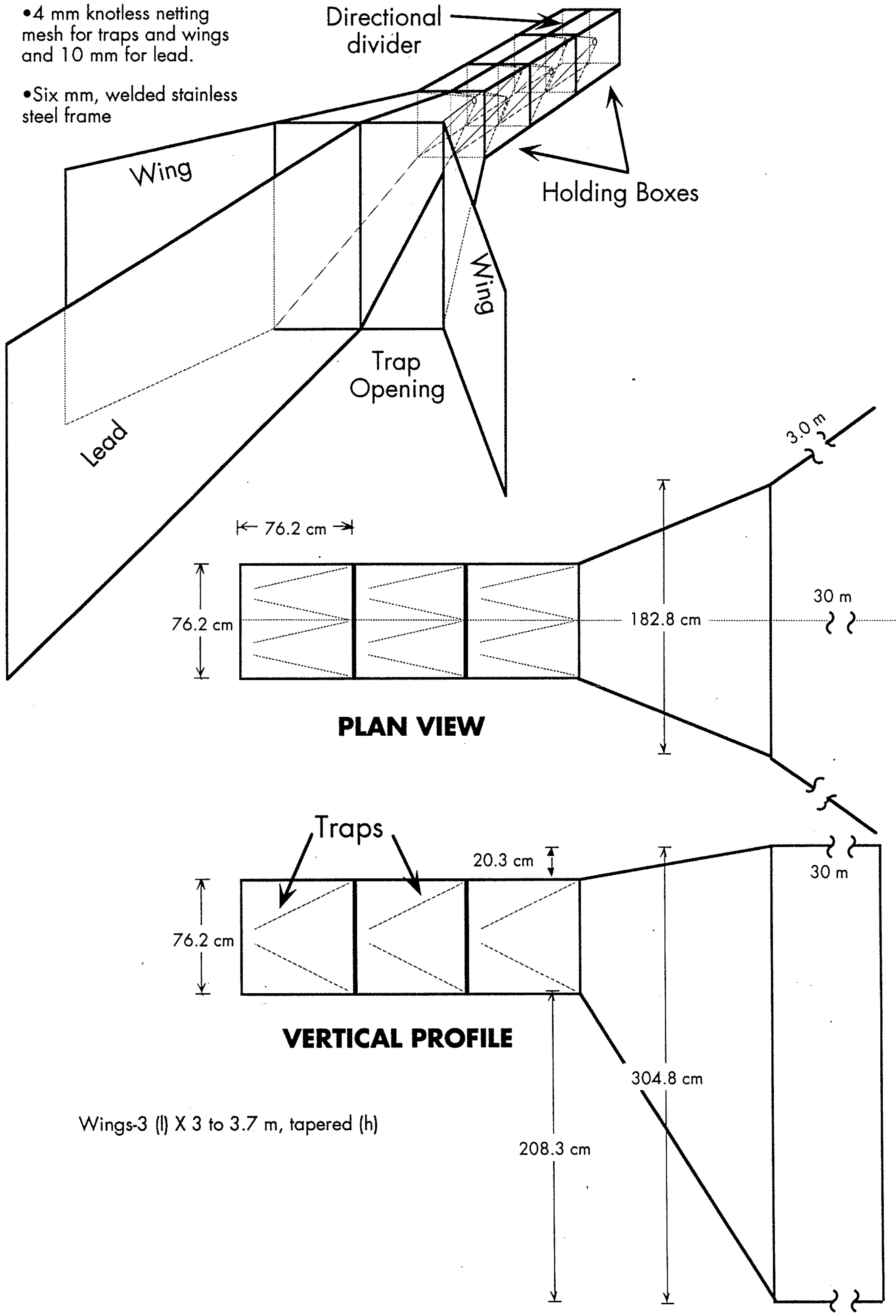


FIGURE 13. Specifications for fyke net used at construction sites. Divider in net allowed for detection of direction of movement

DATA ANALYSIS

In the experimental design, each round about the mole or each hour on a rig at the Everett Homeport were considered replicates for distributions of fish schools. Chi-square analysis was used for the distributions of fish behavior, direction of movement, school size, and locations about the rigs. Simple linear regressions with 95% confidence intervals were used to test for changes in fish TL over time. Unpaired, two-tailed T-tests were used to compare all other effects. All error bars on figures are 1 standard error (SE).

The data were analyzed with StatView SE+ statistical package on an Apple Macintosh computer to compare measured parameters as a function of pile driving effects. Significant effects of pile driving were examined at 0.05 alpha level.

RESULTS

A total of 343 human-hours were spent observing fish schools at the Everett Homeport from March 30-June 15, 1990: 173 hours along shore, 103 hours on the DB Pacific, and 67 hours on The 60. Seven-hundred and forty schools were sighted along shore, with 50% arriving by May 8, and 90% by May 24 (Fig. 14). Two-hundred and thirty three schools were spotted about the rigs: 145 near the DB Pacific, and 88 for The 60 (see Appendix 1 for raw data).

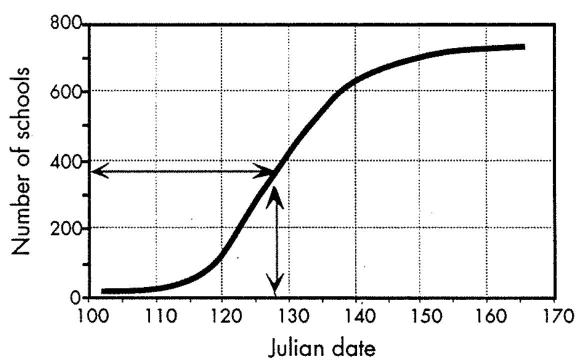


FIGURE 14. Cumulative number of schools spotted from the shoreline (mole) at the Everett Homeport, 1990. Added lines mark the date at which 50% of the schools had passed.

QUALITATIVE/GENERAL OBSERVATIONS

Everett Homeport

Most of the fish schools observed were assumed to be juvenile pink and chum salmon since pink and chum salmon were the only surface oriented species observed in samples from dip nets or beach seines at the site. Most schools sampled with dip nets or beach seines contained both pink and chum salmon in a ratio of approximately 2:1. In addition, observers could usually recognize parr marks on chum salmon, or the green shimmer of pink salmon as the schools milled at or near the surface of the water since schools were rarely >30 cm below the surface.

Most fish schools were found near the carrier pier or the skiff dock (Fig. 15), and any structure in the water such as piles, docks, and the pile driving rigs, seemed to attract schools of fish. For example, schools could be drawn away from shore by approaching them slowly with a skiff and then drifting away from shore with the school remaining next to the skiff. We rarely observed schools passing under objects such as work skiffs or even logs. They would either stop moving once they encountered the floating object or move around it.

Western grebes (*Aechmorphorus occidentalis*) were prevalent at the site, and their presence corresponded positively with the abundance of juvenile pink and chum salmon at the sight from Julian dates 110-125 (Fig. 16). On numerous occasions, these diving birds were spotted with small fish in their beaks upon surfacing next to a rig. However, this correlation was absent between Julian dates 128-142 when fish schools demonstrated their second peak of abundance.

Overall, <5% of the fish at all sites had empty stomachs. Pink and chum salmon sampled at the skiff dock, main carrier pier, and the DB Pacific were primarily feeding on Calanoida, a more pelagic prey item (>95% by abundance, Fig. 17 and Table 2). In contrast, pink and chum salmon sampled at Port Gardner (see Fig 10), had a more epibenthic and varied diet, primarily feeding on *Tisbe* spp.

SIZE OF FISH AND GROWTH

Everett Homeport

Juvenile chum salmon were longer than pink salmon, and TL of the two species did not change significantly over time (Fig. 18). Juvenile pink salmon sampled from the skiff dock were significantly smaller than those sampled at the DB Pacific (Fig. 19).

AR010126

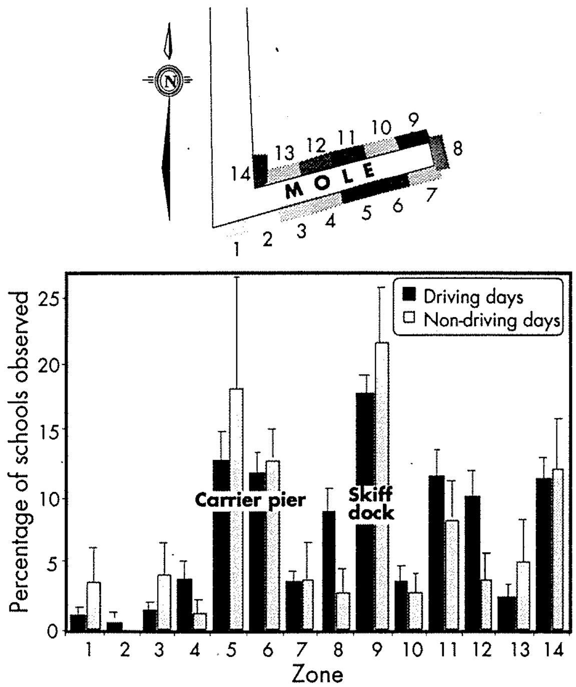


FIGURE 15. Overall frequency distribution of number of fish school observations for each of the 14 zones along the mole at the Everett Homeport. Intensity of gray-scale on map corresponds to the number of schools sighted.

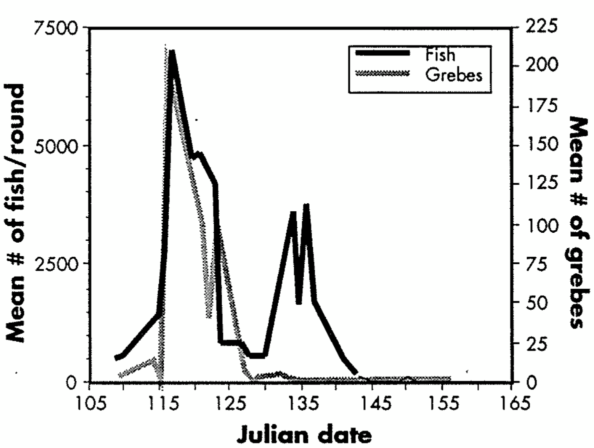


FIGURE 16. Correlation between western grebes and schools of pink and chum salmon at the Everett Homeport Site, 1990.

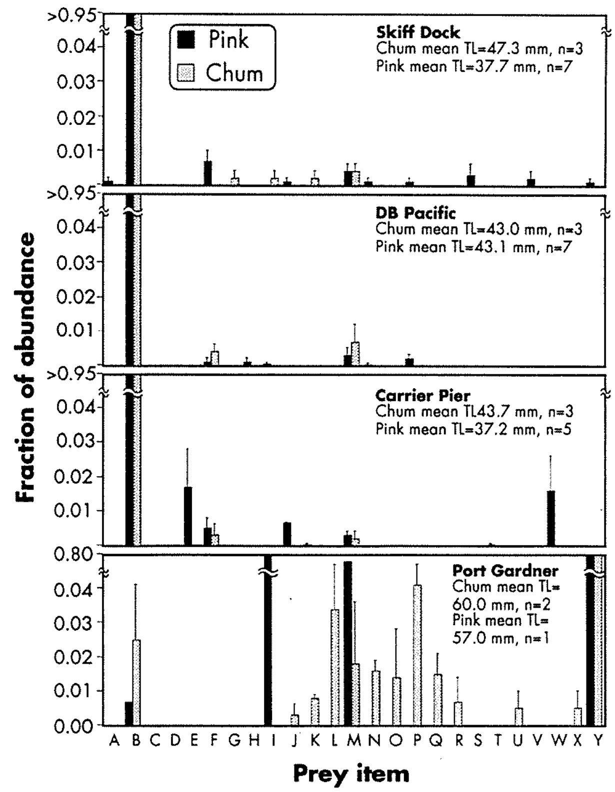


FIGURE 17. Distribution of prey items from stomachs of juvenile pink and chum salmon captured at the Everett Homeport site, 1990. See Table 2 for key.

Table 2. Key for identification of stomach contents analysis.

A	Balanomorpha	N	Gammaridea
B	Calanoida	O	Harpacticoida
C	*Calanus* spp.	P	*Harpacticus* spp.
D	*Calliopius* spp.	Q	Hyperiidea
E	Cirripedia	R	Isopoda
F	Cladocera	S	Laophontidae
G	Collembola	T	*Oithona similis*
H	Crustacea	U	Paguridae
I	*Cumella vulgaris*	V	*Paracalanus* spp.
J	Decapoda	W	*Tachidius triangularis*
K	Diptera-Chironomidae	X	Teleostei
L	Ectinosomatidae	Y	*Tisbe* spp.
M	Euphausiacea		

Elliott Bay

Juvenile pink and chum salmon sampled with beach seines at Elliott Bay appeared to be increasing in size over time (Fig. 20). Pink salmon were not different in TL from chum salmon. We cannot say for sure if fish were growing, or if larger fish were moving in and replacing smaller fish in the area.

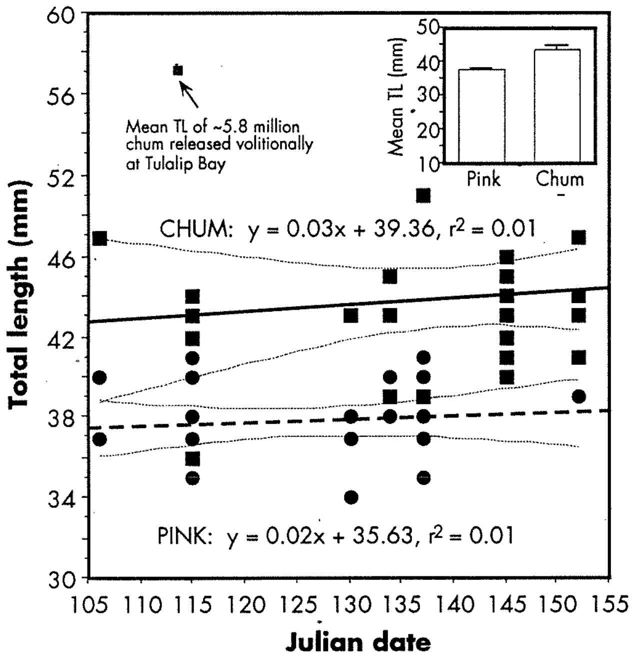


FIGURE 18. Change in total length of juvenile pink and chum salmon over time with 95% confidence intervals. Inset: Mean total length of pooled pink and chum salmon samples at the Homeport site, 1990 (p=0.0001).

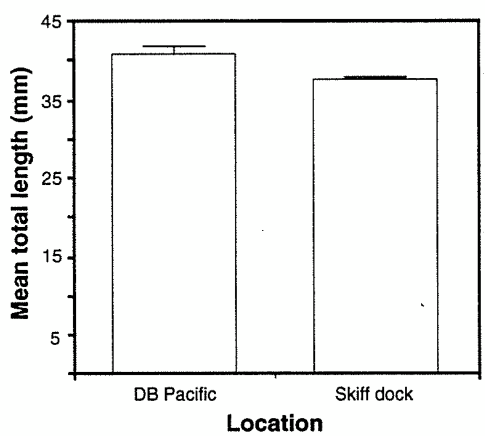


FIGURE 19. Mean total length of pink salmon sampled at the skiff dock versus the DB Pacific (p=0.002).

Kingston

Total lengths for pink and chum salmon were averaged on a daily basis and plotted against date. This plot indicated that both pink and chum salmon in the Kingston area were increasing in size over time (Fig. 21). Whether this was attributable to growth or replacement by larger fish is not known. Pink and chum salmon were not different from each other as far as TL.

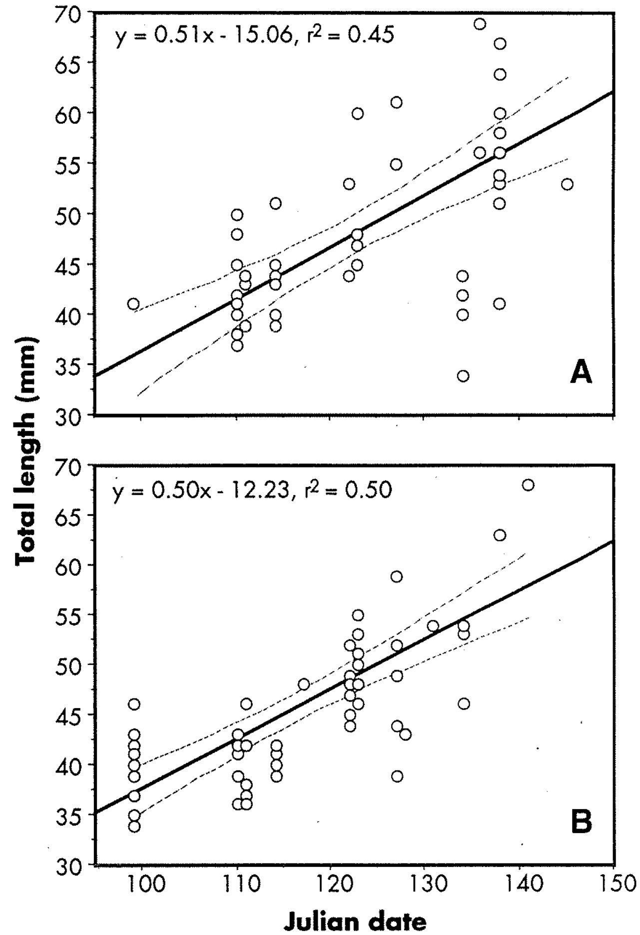


FIGURE 20. Change in total length of pink "A" and chum "B" salmon based on beach seine hauls at Elliott Bay.

SALINITY AND TEMPERATURE

Everett Homeport

Salinity ranged from 11-26‰ and temperature was between 8 and 12°C at the various sites over time. Salinity did not appear to affect the presence and/or absence of fish sampled at the skiff dock (Fig. 22). However, we were not able to compare presence and/or absence over the whole site as a function of salinity.

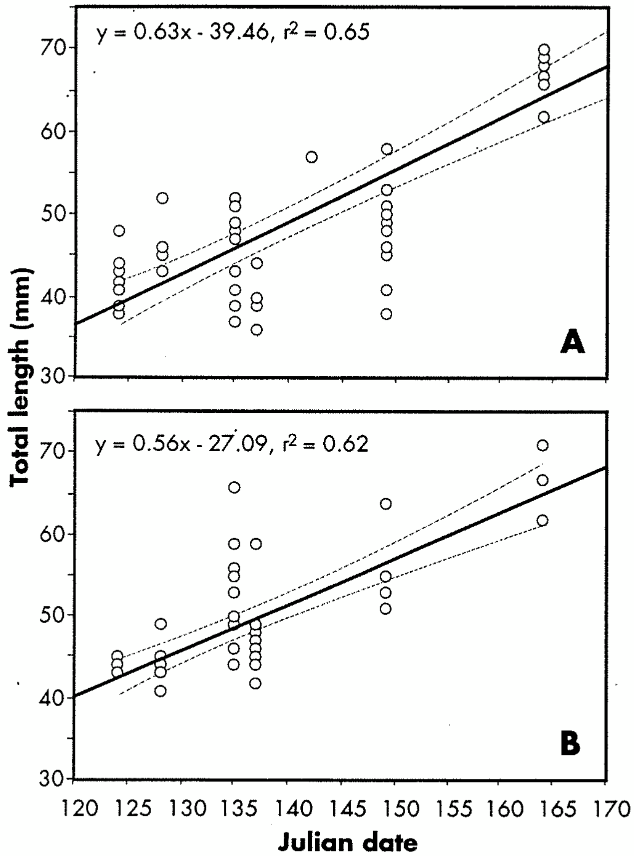


FIGURE 21. Change in total length of pink "A" and chum "B" salmon based on beach seine hauls at Kingston Ferry Terminal

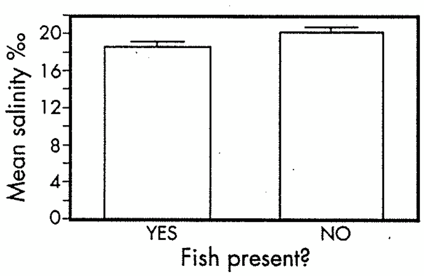


FIGURE 22. Fish presence at the skiff dock as a function of salinity (p=0.089).

Elliott Bay

Measurements of water temperature and salinity are shown in table 3. Surface and bottom measurements were similar throughout the study period.

Table 3. Temperature and salinity profiles at Elliott Bay.

DISTANCE FROM SHORE	EAST BEACH surface	EAST BEACH bottom	WALL surface	WALL bottom	WEST BEACH surface	WEST BEACH bottom
0 m	15°C 26‰		12°C 28‰		15°C 26‰	
10 m	13°C 27‰	13°C 27‰	12°C 28‰	11°C 28‰	12°C 27‰	11°C 28‰

Bremerton

Surface and bottom measurements of salinity were similar throughout the study period. Salinity was typically 28‰.

Salinity and temperature measurements taken at the same locations as the fish observations showed that the water was not stratified with respect to salinity or temperature.

Kingston

CTD profiles showed only minor variation in all three measures between the depths sampled at each location, and between locations. Salinity was typically 28‰, and temperatures were 11-12°C.

SOURCES OF FISH OBSERVED

Everett Homeport

We assumed that all of the juvenile pink salmon sampled at this site were wild stocks as there were no pink salmon hatcheries in the study area. We assumed that the majority of chum salmon observed at the site were wild stocks migrating out of the Snohomish River for the following reasons. There were three hatcheries where chum salmon were released in the vicinity of the Homeport (Fig. 2): the Tulalip Tribal Hatchery release, Tulalip Bay (10 Km from the site); Arlington Hatchery on the Stillaguamish River (>50 Km from the site); and a WDF facility on the Wallace River, a tributary of the Snohomish.

The Tulalip Tribe released 5.8 million chum on their own volition from April 26 to May 3 (mean TL on April 23: 57.1 mm, SE=0.297, 660 fish/Kg, 877 Kg total) into Tulalip Bay. Given the significantly smaller sized chum salmon captured at the Homeport site throughout the study, it seems unlikely that any of these hatchery fish could have been observed at the site, certainly not in the nearshore area. Further, Beauchamp et al. (1987), sampling throughout the Port of Everett and Port Susan area, observed increases in chum salmon abundance and mean TL in response to 2.3 million chum salmon released into Tulalip Bay by the Tulalip Tribe. However, the effect was localized to sites within 1 Km of Tulalip

Bay, and increases in chum salmon abundance and mean TL were not observed at more distant (>1 Km) sampling areas. The Arlington hatchery on the Stillaguamish River released 99,832 chum on April 13 (855 fish/Kg, 54.7 mm mean TL, reared 73 days). Since these fish were released more than 50 Km from the Homeport, and the total number released was quite low, we assumed there was no effect. The WDF hatchery on the Wallace River reportedly released "negligible" numbers of chum salmon in 1990.

Elliott Bay

We assumed that the majority of salmonids captured in beach seines and observed from shore originated from the Duwamish Waterway. However, this assumption could not be quantified

Bremerton

While we do not have direct information on the source of fish observed at Bremerton, it seems reasonable that many of the chum salmon came from a hatchery located on Gorst Creek. Gorst Creek flows into Sinclair Inlet about 5 to 6 Km from the Bremerton Ferry terminal. Many of the juvenile chum captured in beach seine sets and fyke nets were not buttoned-up.

Kingston

We could not make an estimate of the origin of fish observed and captured at Kingston. However, the fish present at Kingston were larger than those captured at Bremerton and presumably older.

PILE DRIVING STATISTICS

The DB Pacific and The 60 rigs at the Everett Homeport drove piles from March 30-June 15, and March 30-May 23, respectively (Fig. 4). There were 47 days of pile driving and 17 days of non-pile driving during this period. However, the majority of fish school observations were made between Julian dates 120 and 140, a period during which there were 11 pile driving and 4 non-pile driving days. Pile driving rigs struck piles about 50 times per minute, and the average pile took 10 to 15 minutes to drive (Fig. 4). The entire process for driving one pile usually took 30-60 minutes, depending on sediment type and pile length. The amount of time each day spent striking piles was relatively constant throughout the study period (Fig. 4). However, the number of piles driven each day slowly increased over time since the mean time to drive any given pile decreased over time (Fig 4).

THE ACOUSTIC ENVIRONMENT

The results of the acoustic sampling phase of this study are incomplete. Lack of funding and gear malfunction prevented completion of both sampling and analysis stages of the study. While sound was recorded at Kingston, Bremerton, and Elliott Bay, an analysis of these data has not occurred.

Based on the limited data available from the Everett Homeport, SPLs were up to 25 dB above ambient levels, at a range of 593 m from the DB Pacific (Fig. 23).

FISH ABUNDANCE OVER TIME

Everett Homeport

Although the outmigration appeared unimodal based on the number of schools spotted per round of the mole, an estimate of the total number of fish spotted per day based upon the mean size of fish schools, suggests the outmigration was bimodal (Fig. 24). Perhaps the first peak was pink salmon and the second was chum. On both of the construction rigs, there were no peaks in the number of schools sighted or in fish school size. Schools simply were not spotted on the DB Pacific after Julian date 152 (Fig. 25). Observations ceased on The 60 rig on Julian date 143 because the rig had finished its project.

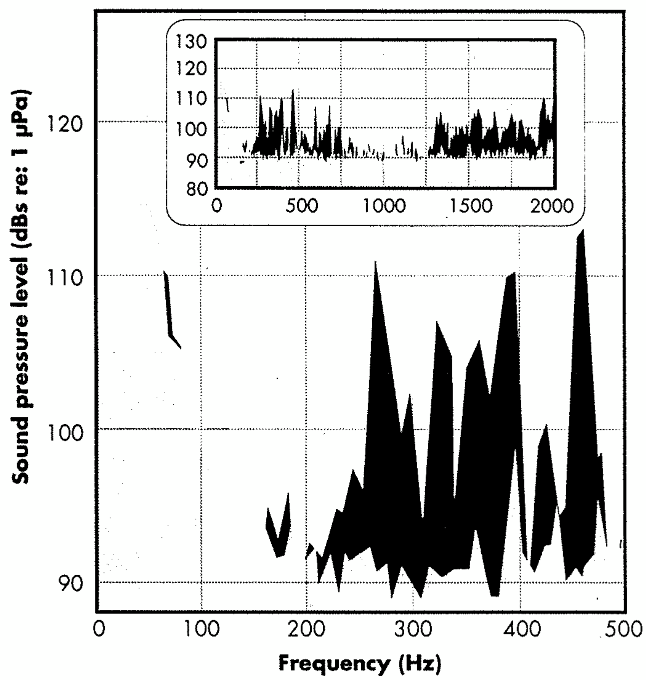


FIGURE 23. The acoustic environment 593 m from the DB Pacific, hydrophone at 1.5 m water depth. Black is pile driving noise, gray is ambient.

Elliott Bay

During the entire study no fish were sighted under or near the FAD, irrespective of its location or attempts to lead juvenile salmonids to this structure. Similarly, during the trapping with the fyke net, no fish were caught.

There were large fluctuations in the abundance of juvenile salmonids captured from one day to the next (Fig 25, Table 4) in the beach seines and the species composition changed over time. On average, fewer juvenile salmonids were caught during ebb tide compared with flood tide. Initially, the catches were composed of primarily pink and chum salmon. Coho and chinook salmon began to appear in the samples in early May, simultaneously the pink and chum salmon abundance began to decrease. Both the coho and chinook salmon abundance continued sporadically throughout the rest of the study (Table 2).

The west beach experimental unit consistently had fewer juvenile salmon than the east beach experimental unit (Table 4).

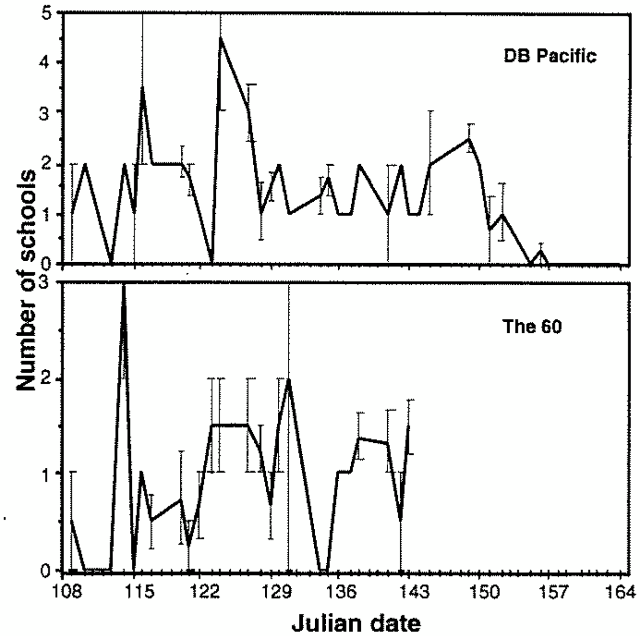


FIGURE 25. Mean number of schools sighted per hour on the DB Pacific and The 60 rigs over time.

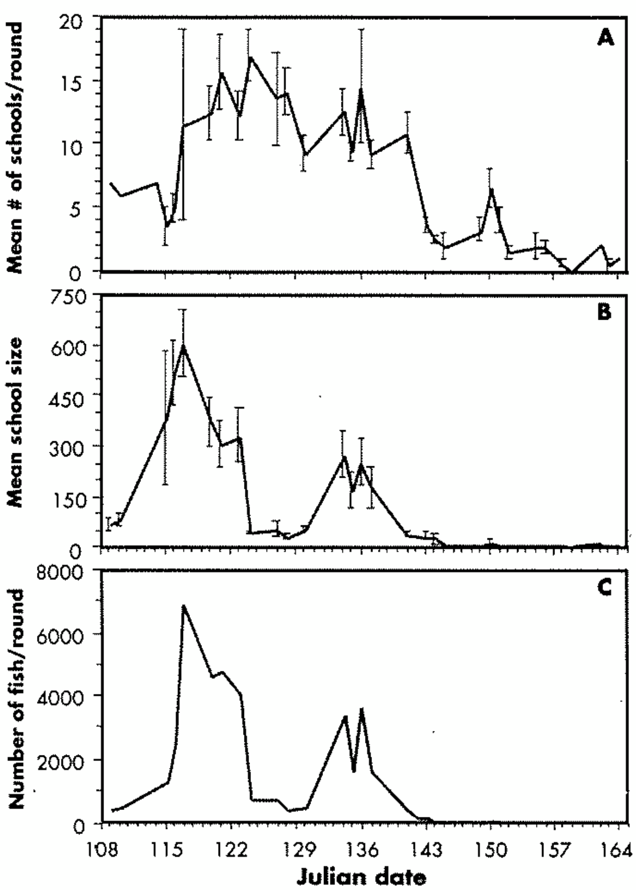


FIGURE 24. Abundance of juvenile pink and chum salmon over time along the shore at the Everett Homeport, 1990. A] Mean number of schools per round. B] Mean school size per round. C] Estimated number of fish per round.

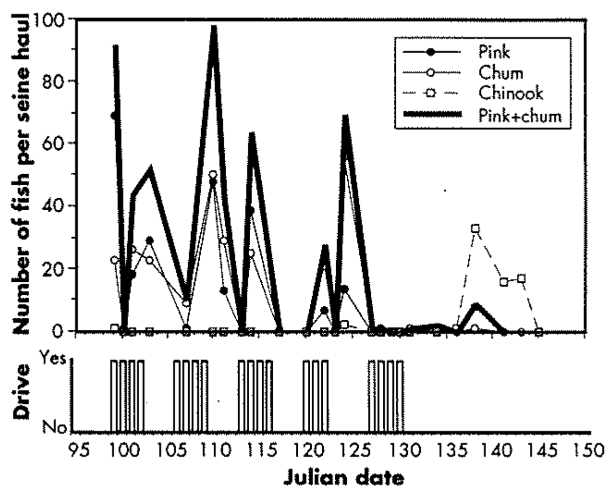


FIGURE 26. Abundance of pink and chum salmon at the Elliott Bay site over time based on beach seine sampling at the east beach. Bars on lower figure indicate whether or not pile driving was occurring.

Bremerton

During the early part of the study less than a dozen salmonids were sighted near the waterfront area of Bremerton (Fig. 27). Similarly, the fyke net caught only a few fish while it was installed. Several weeks after construction had stopped, small schools (usually fewer than 100 individuals) were occasionally sighted.

Table 4. Number of salmon caught in the beach seine, by date and species in Elliott Bay. Plus or minus indicate flood or ebb tide respectively. Dr. hrs=# of hours pile driving occurred on a given day. A=Tide; B=pink; C=chum; D=coho; E=chinook, F=Pile driving.

	East Beach						West Beach						
Date	Seine	A	B	C	D	E	Seine	A	B	C	D	E	F hrs
409	5	+	69	23	0	1	0	+	•	•	•	•	5
410	5	+	0	1	0	0	10	+	4	8	0	0	4.5
411	7	+	18	26	0	0	6	+	3	10	0	0	6
412	0	+	•	•	•	•	0	+	•	•	•	•	2
413	8	+	29	23	0	0	0	+	•	•	•	•	0
416	0	+	•	•	•	•	13	+	0	0	0	0	4.5
417	5	-	1	9	0	0	5	+	0	1	0	0	2.5
418	0	+	•	•	•	•	0	+	•	•	•	•	2
419	0	+	•	•	•	•	0	+	•	•	•	•	6.5
420	4	-	48	50	0	0	6	-	7	41	0	0	0
421	3	+	13	29	0	0	0	+	•	•	•	•	0
423	8	-	0	0	0	0	7	+	0	0	0	0	3
424	3	+	39	25	0	0	8	+	0	0	0	0	5.5
426	0	+	•	•	•	•	5	+	0	0	0	0	6
427	6	+	0	0	0	0	6	+	0	1	0	0	0
430	6	+	0	0	0	0	9	+	0	0	0	0	2.5
501	0	+	•	•	•	•	0	+	•	•	•	•	3.5
502	8	+	7	21	0	0	7	+	0	0	0	0	3
503	6	+	0	0	0	0	6	+	2	3	0	4	0
504	6	+	14	56	1	2	6	+	0	1	1	0	0
507	7	+	0	1	0	0	6	+	2	5	1	1	1
508	8	-	0	1	0	0	8	+	0	0	0	0	4.5
509	8	+	0	0	1	0	7	+	0	0	0	0	2
510	6	+	0	0	0	0	6	+	0	0	0	0	2.5
511	8	+	0	1	0	0	7	+	0	0	0	0	0
514	7	-	1	1	0	0	6	-	3	2	0	0	0
516	6	-	0	0	0	1	6	-	1	0	2	2	0
518	8	-	8	1	4	33	7	-	4	0	1	5	0
521	7	+	0	0	0	16	8	+	0	2	1	11	0
523	7	+	0	0	0	17	7	+	0	0	0	0	0
525	7	+	0	0	0	0	8	+	1	0	0	0	0
530	6	-	0	0	0	1	6	-	0	0	0	0	0

Salmonids (less than 20) were captured by beach seine during the construction period (Fig. 28). Several weeks after construction had stopped, juvenile salmonids began to appear in larger numbers in the beach seine sets. The majority of these fish were captured at the site northeast of the rip-rap and boulder wall.

During and shortly after pile driving activities, juvenile salmonids were not present in beach seines, fyke nets, or visual observations anywhere along the Bremerton waterfront. The beach was clean and appeared to be periodically scoured be currents generated by the car ferries. Little marine life was visible along the intertidal area from the existing ferry terminal to beyond the public moorage. Nearly a month after the end of the pile driving activities small numbers of salmonids began to be observed and were occasionally captured at the beach seine site near the ferry terminal and in some abundance north of the rip-rap wall indicating that juveniles might move into the area later in the spring. At no time were large numbers of salmonids observed near the ferry terminals.

Turbulence created by ferry landings or departures, increased turbidity, and moved the water *en masse* away from the ferry. A small wall of water then moved toward the public moorage at an estimated velocity of 4 to 8 m.p.h. The existence of high currents was hypothesized to account for the lack of any significant sightings of salmonids in the waterfront area, at least during early spring. In addition, a general lack of marine life may have been due to the periodic strong currents. However, larger fish would be better able to contend with the currents than small young individuals, and this may account for the presence of salmonids later in the spring.

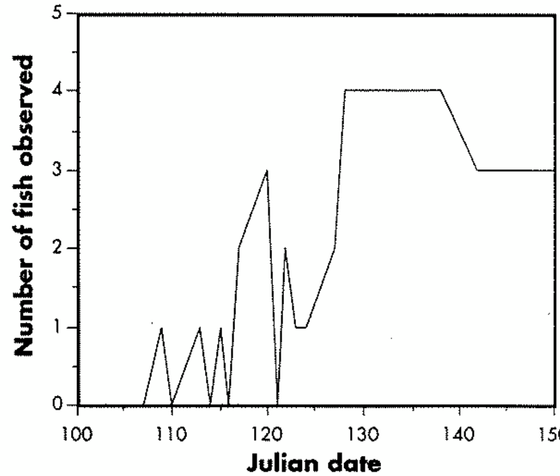


FIGURE 27. Number of fish at site based on fyke net/human observation over time at the Bremerton site.

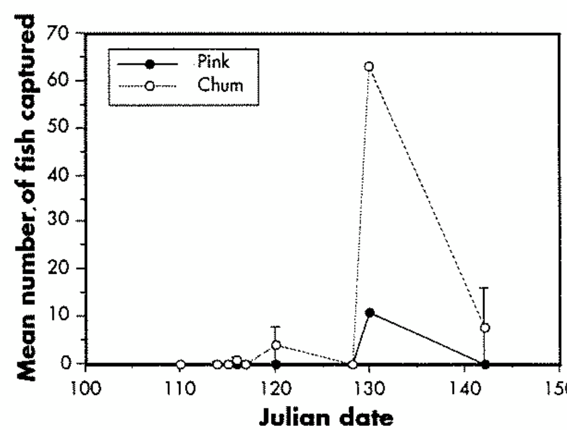


FIGURE 28. Abundance of pink and chum salmon over time at the Bremerton site based on beach seine data.

Kingston

Beach seine catch data indicates that the abundance of juvenile salmonids in the area of the beach underwent a drastic reduction (Fig. 29). Initial sampling efforts yielded a CPUE of approximately 460 salmon/set. This high CPUE dropped off to <10 salmon/set by May 17, and was 0.5 salmon/set at the end of June.

The fyke net was effective in catching salmon only during the first few days it was fished. CPUE dropped off from a high of 1800 fish/hour on 5/16 to <1 fish/hour on 6/1/90.

Estimates from human observers of the abundance of salmon for the shoreline (rip-rap and jetty), near-shore (support #3 to #14), far shore (#14 to end) and the dolphin area indicate when a peak abundance occurred in the Kingston area (Fig. 30), after which there was a drastic reduction in fish abundance.

EFFECTS OF PILE DRIVING ON MEASURED VARIABLES

Everett Homeport

Out of the 973 schools observed, one school responded to the initiation of a pile being driven at close (10 m) or long (100-200 m) range. Indications of a response were "starting" or "flashing" at the onset of pile driving.

There were more schools spotted per round of the mole on non-pile driving days (14.1) compared to pile driving days (11.9), but this difference was not significant (Fig. 31). However, there were significantly more schools spotted on the each of the rigs per hour on non-pile driving days compared to pile driving days (Fig. 32).

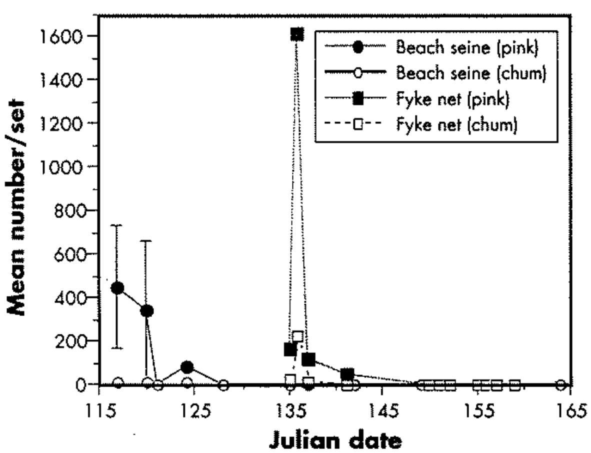


FIGURE 29. Abundance of juvenile salmonids at the Kingston site based on fyke net and beach seines samples.

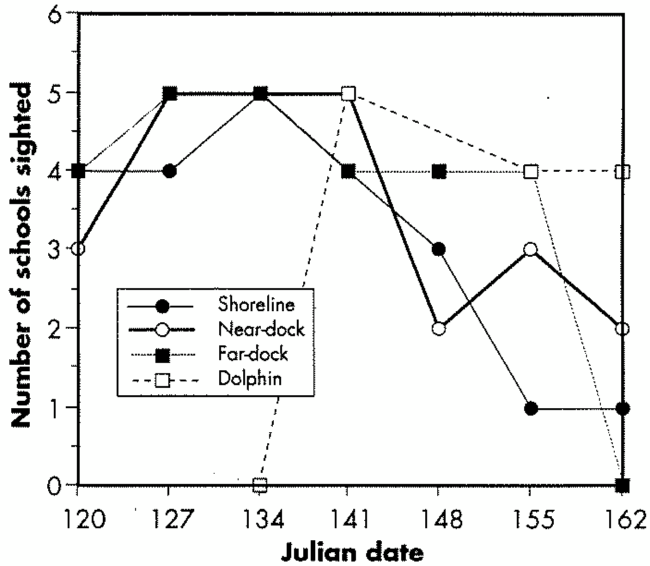


FIGURE 30. Prevalence of juvenile salmonids at the Kingston site based on observations.

The ratio of number of schools on the cove side to number of schools on the construction side of the mole was about 2:1 on pile driving days and 1:1 on non-pile driving days (Fig. 33), and this difference was significant. The distributions of fish schools changed as a function of pile driving on The 60, but not on the DB Pacific rig (Fig. 34).

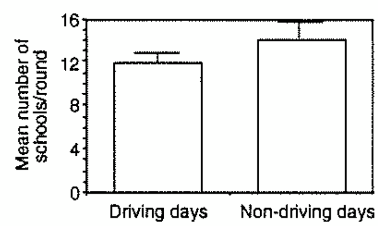


FIGURE 31. Mean number of schools/round at the Everett Homeport with and without pile driving (p=0.228). Julian dates 123/124, 127/128, and 134/135.

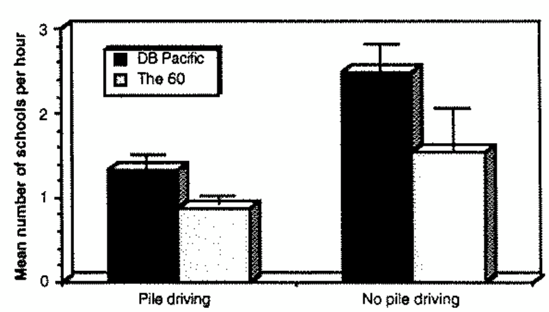


FIGURE 32. Mean number of schools sighted per hour on both pile driving rigs at the Everett Homeport, 1990. Julian dates 109-143. DB Pacific: p=0.0003, The 60: p=0.041.

Fish schools about the mole were usually 2 m from shore in about 1.2 m of water. There were no significant differences in distance from shore or water depth as a function of pile driving.

Pile driving significantly affected the size of fish schools present on the construction side, but not on the cove side (Fig. 35). However, neither of the pile driving rigs showed differences in fish schöol size distributions with and without pile driving (Fig. 36).

The Chi-squared distributions of the three fish behaviors changed significantly in response to pile driving on the construction side of the mole, but not on the cove side (Fig. 37). Fish behavior was not significantly different between the two rigs, so the data were pooled and there was a significant difference in the distributions of fish behavior as a function of pile driving (Fig. 38). Cloud cover had a significant effect on the distributions of fish behavior on the cove side, but not on the construction side. Tidal stage had no effect on the distributions of shoreline fish behavior. Cloud cover, time of day, and tidal stage did not affect the distributions of fish behavior on either of the two rigs.

There was a significant difference in the distributions of fish school direction of movement as a function of pile driving on the cove side of the mole, but not on the construction side (Fig. 39). There were no significant differences in the distributions of fish school direction of movement on either of the rigs (Fig. 40). Cloud cover significantly altered the distribution of fish school direction of movement on both sides of the construction site, but tidal stage (ebb or flood classification) had no measurable effect on the distributions of fish school movement.

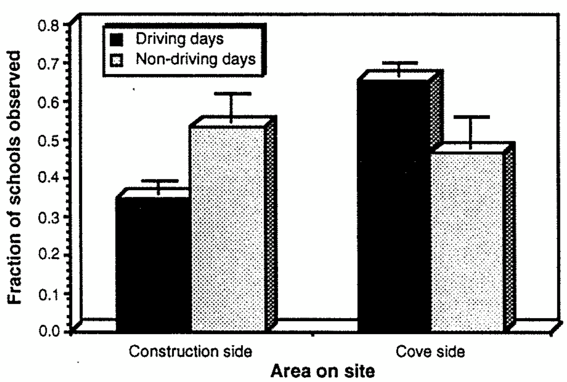


FIGURE 33. Distribution of fish schools on each side of the mole for Julian dates 116, 120-130, and 134-137 (p=0.015).

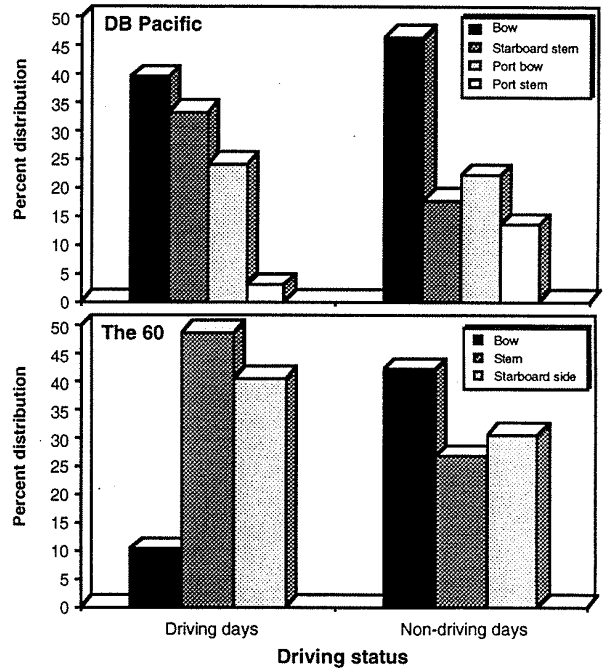


FIGURE 34. Distributions of fish schools about the DB Pacific and The 60 rig. No rainy days, one observer only. DB Pacific: Total Chi-square=6.717, p=0.081. The 60: Total Chi-square=10.665, p=0.005.

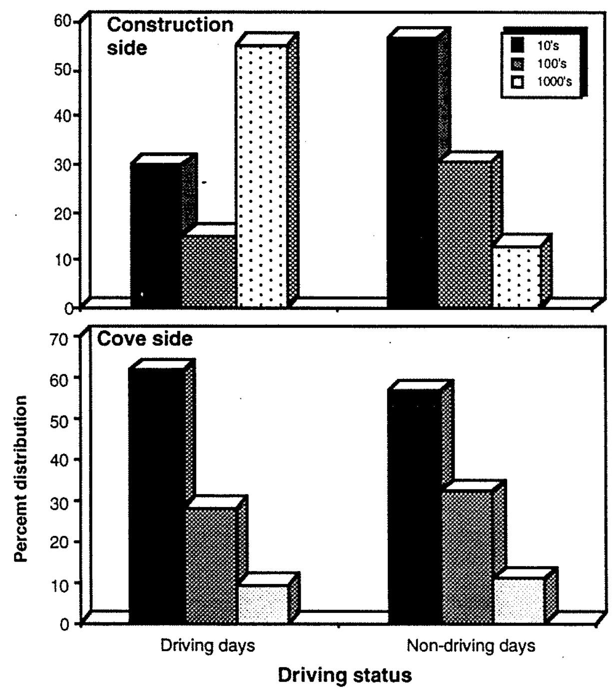


FIGURE 35. Distribution of fish school sizes with and without pile driving for each side of the mole. Julian dates 116, 117, 124, 127, 128, 131, and 134, no rainy days. Construction side: total Chi-square=12.838, p=0.002. Cove side: total Chi-square=0.162, p=0.922.

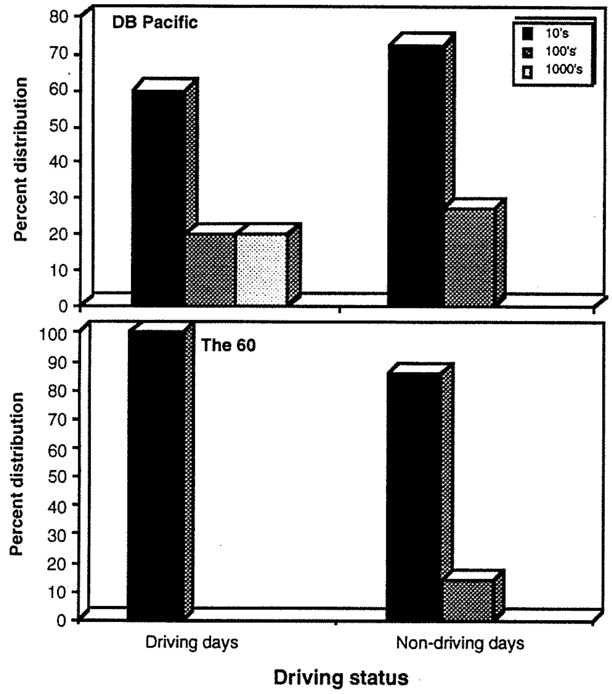


FIGURE 36. Distribution of fish school size around the DB Pacific and The 60 rigs with and without pile driving. Julian dates 109/110, 116/117, 123/124, 127/128, 130/131, one observer, no rainy days. DB Pacific: total Chi-square=4.707, p=0.095. The 60: total Chi-square=2.154, p=0.142.

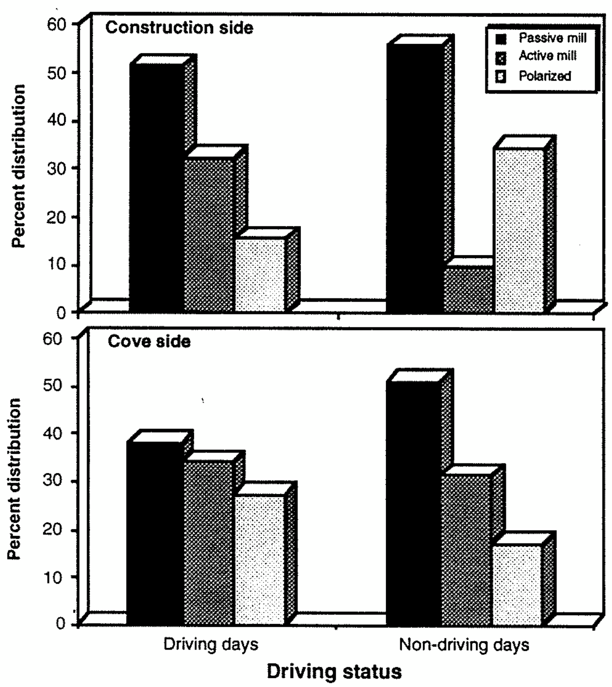


FIGURE 37. Distributions of fish behavior with and without pile driving on the construction side and cove side of the mole. Julian dates 89-143, no rainy days Construction side: total Chi-square=12.442, p=0.002. Cove side: total Chi-square=4.025, p=0.134.

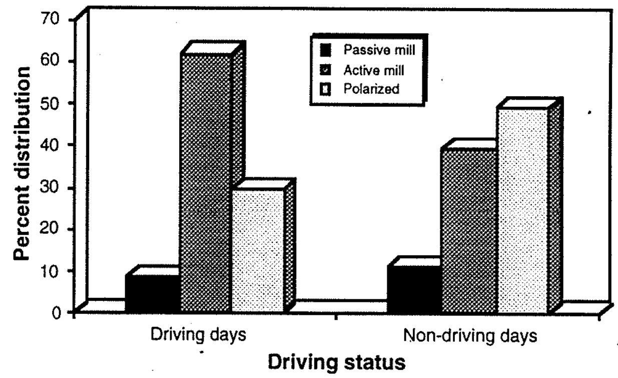


FIGURE 38. Distributions of fish behavior with and without pile driving on both pile driving rigs. No rainy days, one observer. Total Chi-square=9.009, p=0.011.

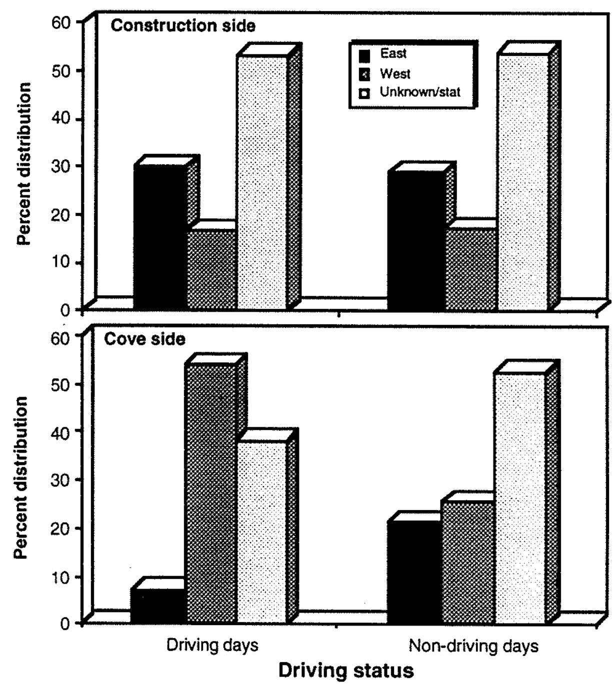


FIGURE 39. Distributions of fish school movement on each side of the mole with and without pile driving. Julian date 89-143, no rainy days. Construction side: total Chi-square=0.0240, p=0.9880. Cove side: total Chi-square=18.5300, p=0.0001.

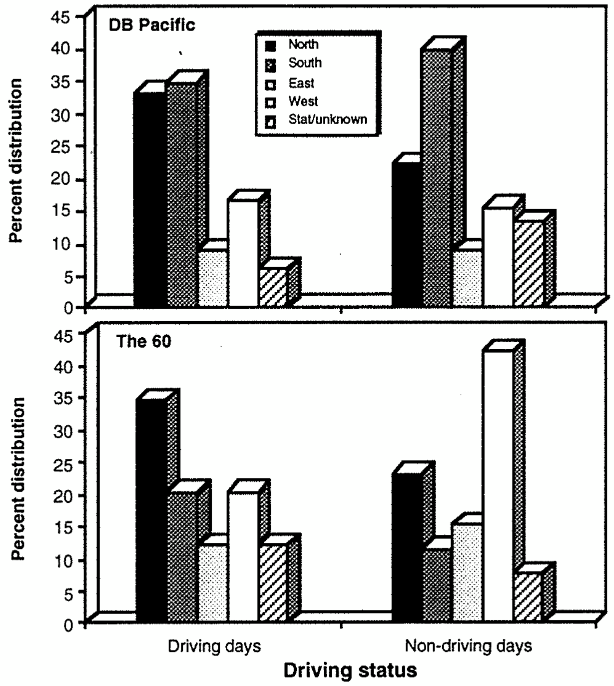


FIGURE 40. Distributions of fish school movement on the DB Pacific and The 60 rigs with and without pile driving. One observer, no rainy days. DB Pacific: total Chi-square=4.884, p=0.299. The 60: total Chi-square=2.931, p=0.569.

Elliott Bay

The impacts of pile driving were difficult to measure at this site. Juvenile salmonids were never at high densities like those found at the Everett Homeport. Nevertheless, a simple abundance estimate was possible based on beach seine data (Fig. 41), where there were more fish captured on non-pile riving days compared to driving days, but this difference was not significant.

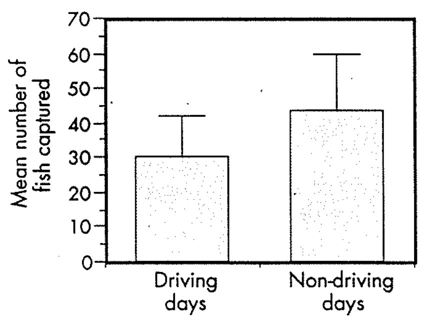


FIGURE 41. Abundance of juvenile pink and chum salmon at the Elliott Bay site as a function of pile driving. Julian dates 99-124, n=8 for driving days, 6 for non-driving, p=0.495.

Kingston and Bremerton ferry terminals

The effects of pile driving on juvenile salmonids could not be assessed at the Kingston site because pile driving did not occur. At Bremerton, there was limited pile driving activity that occurred before juvenile salmonids arrived at the site.

DISCUSSION

The first few weeks in the estuary is a critical time for juvenile Pacific salmon (Manzer and Shepard 1962; Simenstad et al. 1982; Levings et al. 1989), during which there is high mortality (Godfrey 1958; Ricker 1962; Foerster 1968; Parker 1968; Ricker 1976; Peterman 1982; Bax 1983). Fish are particularly subject to stress during this period. In this discussion, we will address the potential impacts of pile driving sounds on fish at the Everett Homeport, and the general ecological information garnered from this study. Then, we will address the results concerning changes in fish behavior and ecology in response to pile driving noise, and the limitations of this study.

THE ACOUSTIC ENVIRONMENT AND FISH ECOLOGY

Chronic exposure to moderate sound levels can alter fish ecology. Fry of *Cyprinodon variegatus* and *Fundulus similis* exposed to a SPL 20 dB above control noise levels exhibited diminished growth (Banner and Hyatt 1973). Meier and Horseman (1977), were able to influence fat stores, growth rates, and reproductive indices in *Tilapia aurea*, by operating a buzzer wrapped in plastic in aquaria with the fish. Contrary to the results of Banner and Hyatt (1973), sound appeared to improve growth rates and fat stores. The reason for this apparent difference might be that Meier and Horesman used short (20 minutes/day) stimuli in a Pavlovian classical conditioning context, whereby fish learned to associate the sound with being fed. Sound levels at the Homeport site certainly were at least 20 dB above ambient, but these were transient as opposed to continuous sounds. The question of whether or not pile driving diminishes growth in juvenile pink and chum salmon cannot be answered in the scope of this study.

High intensity sounds may temporarily or permanently damage the hearing of fish. Popper and Clarke (1976) found that goldfish (*Carassius auratus*) demonstrated up to a 30 dB decrease in hearing sensitivity when exposed to 149 dB re: 1 µPa for 4 hours, but that hearing returned to normal after 24 hours. Enger (1981) used a SPL of 180 dB re: 1 µPa to destroy bundles of cilia on the saccular maculae of codfish as evidenced by scanning electron microscopy. This treatment was presumed to cause permanent hearing loss. Cox et al. (1987) also were able to destroy cilia on the saccular and lagenar maculae of goldfish with high SPLs. While the SPL at pile driving sites does not appear to be at intensities capable of this damage, experiments regarding the minimum SPL that damages fish hearing have not been conducted for salmon. Therefore, it is conceivable that fish in close proximity (<10 m) to a pile being driven will experience temporary or permanent hearing loss.

Juvenile pink and chum salmon almost certainly cannot perceive the sounds of pile driving on the cove side of the mole because the mole acts as an acoustic muffle. Based on the audiogram generated by Hawkins and Johnstone (1978), the sounds of pile driving on the construction side of the mole appear to be within the perceivable frequency range of salmonid species (Figs. 1 and 14). The question remains as to whether or not the intensity is sufficient for audition. There are a number of limitations on comparing the audiogram produced by Hawkins and Johnstone (1978) to that of juvenile Pacific salmon.

First, the audiogram was derived from Atlantic salmon ranging in length from 32 to 36 cm TL, and about 500-700 g. Pink and chum salmon at the Everett Homeport were typically 38 and 44 mm TL, and about 0.5 to 1.0 g. Since salmonids appear to rely entirely on their inner ear and lateral line for hearing, and are most sensitive to particle velocity rather than sound pressure (they do not appear to have a transducer such as a Weberian apparatus for converting sound pressure into particle displacement), it seems reasonable to assume that a fish with larger otoliths (and a greater moment of inertia) might have a different audiogram than a fish with smaller otoliths. However, there are no studies on salmonids to document this.

Since the sounds produced by pile driving are "transient" in nature, analysis of the SPL requires sampling over a set time interval or integration time. The duration of this integration time changes the power spectra of the signal being analyzed. The longer the interval, the lower the overall SPL will become for the same signal. Ideally, the integration time should correspond to the minimum integration time required for the target species to perceive sound of a given source. This critical interval will vary with source frequency and intensity, and with fish species. Since the critical interval for juvenile Pacific salmon is not known, it becomes difficult to say for certain whether or not they will be able to hear the sounds of pile driving. Fay and Coombs (1983) found that the interval at which sound pressure had to be increased in order for the fish to continue perception of a given frequency (400 Hz pure tone) occurred somewhere between 320 and 710 ms for goldfish. The analysis window integration time for this study was 160 ms. If the critical interval of juvenile pink and chum salmon is greater than this, the levels presented will appear high. If the interval is less than this, the levels presented will appear low.

In order to assess whether or not pile driving sounds are audible to juvenile pink and chum salmon, we have synthesized the following criteria from the literature. First, the SPL must be at least that of the minimum audible field of salmon in Figure 1 for the frequencies of interest. Analysis of the sound field 593 m from the DB Pacific at the Homeport showed significant acoustic energy between 200 and 400 Hz. Second, ambient noise should be at least 24 dB less than the minimum audible field of the fish; otherwise masking will occur, and the fish will not hear the sound stimulus (Hawkins and Johnstone 1978). Ambient levels at the Homeport site were 80 to 90 dB re: 1 μPa, and this is 10-30 dB below the minimum audible field of Atlantic salmon. Third, Olsen (1969 and 1976) found that the stimulus SPL had to be 20-30 dB higher than ambient noise levels in order to induce a behavioral response in Atlantic herring. Sound levels between 200 and 400 Hz at the Homeport were at least 20 dB above ambient, 593 m from the source. Finally, broad-band, pulsed sound rather than continuous, pure tone sounds are more effective at altering fish behavior (see Hering 1968 in Olsen 1971; Olsen 1971; Blaxter et al. 1981b; Schwarz and Greer 1984). The sounds produced by pile driving are pulsed and broad-band.

Another impact that pile driving sounds might have on juvenile pink and chum salmon is auditory masking. Masking occurs when adjacent frequencies to the stimulus frequency are present. Therefore, it is conceivable that pile driving noise masks the sounds of approaching predators making them more difficult to detect by juvenile salmonids. Another possibility is that juvenile salmon may habituate to the sounds of pile driving and "ignore" the sound of an approaching predator. Qualitatively, fish schools on the construction side of the site were less apt to startle when approached by observers compared to schools on the acoustically isolated cove side of the site, indicating habituation to the sound may have occurred.

In summary, it is conceivable that the sounds produced by a pile driving rig are audible to juvenile Pacific salmon from more than 600 m from the source. In trying to assess the impacts of any stimulus on an organism, one must consider the biological relevance of that stimulus. Juvenile pink and chum salmon may clearly hear the sounds of pile driving from great distances. However, the perceived relevance of that signal to the fish cannot be answered without further research concerning salmonid audition.

GENERAL FISH ECOLOGY

The following discussion does not provide particular insight into the effects of pile driving on the ecology of juvenile pink and chum salmon. However, it does present pertinent information regarding salmonid ecology at the mouth of the Snohomish River (Everett Homeport), and the Kingston Ferry Terminal.

Everett Homeport

The precise correlation of western grebes with the first peak of the outmigration suggests that these diving birds were feeding on outmigrating juvenile salmon. Whether or not this predation contributed significantly to pink and chum salmon mortality is not known. Wood (1987a and 1987b), found that predation on juvenile salmonids by the common merganser (*Mergus merganser*) had a significant impact on juvenile coho salmon in their natal streams, but did not have a significant impact on fish in tidal waters.

The observation that TL of pink and chum salmon did not increase over time is consistent with previous research in the Port of Everett and other nearshore estuarine areas. Beauchamp (1986) and Beauchamp et al. (1987) found that pink and chum salmon TL did not increase significantly in freshwater sampling areas near the mouth of the Snohomish until late May. McEntee et al. (1985), did not observe an increase in fork length (FL) for juvenile pink and chum salmon sampled with a beach seine at the Homeport site, but did see an increase for purse seine sampled fish. Sturdevant et al. (1991) also found that juvenile pink salmon did not exhibit an increase in FL through April and early May in Prince William Sound, Alaska. Therefore, it seems logical to assume that the fish observed at the Homeport were probably transient, moving rapidly through the area. The possibility that the fish were holding-up and not growing is conceivable. However, this becomes unlikely when the rate of feeding is considered.

The co-occurrence of pink and chum salmon in fish schools has been documented in the literature (Irie et al. 1981), and the Everett Homeport was no exception. Virtually all dip-net and beach seine sets produced pink and chum salmon together.

The dietary composition of fish sampled at the Homeport site was within established norms given the environment they were captured in. Fish were sampled from steeply sloping rip-rap shores, hardly an optimal environment for epibenthic organisms to flourish. Irie (1987), found that juvenile chum salmon (47 mm mean FL) primarily fed on small calanoida or harpacticoida in small harbors around eastern Hokkaido, Japan, an environment similar to that of the Homeport site. Stomach content studies conducted in the Everett Harbor area prior to Homeport construction activities (Schadt and Weitkamp 1985), indicate that juvenile pink and chum salmon primarily fed on epibenthic organisms such as gammarid amphipods and harpacticoid copepods, but there were significant quantities of pelagic species, such as calanoid and cyclopoid copepods in the diet. Fish sampled by purse seine sets in the same area primarily had insects, euphausids, and calanoid and cyclopoid copepods, a more pelagic diet (Schadt and Weitkamp 1985). Therefore, it is not surprising to find that the fish in this study fed almost entirely on pelagic prey items like calanoida.

The suite of behaviors exhibited by juvenile pink and chum salmon at the Everett Homeport is significant if we wish to understand how pile driving might affect fish at this particular site. Fish school were always surface oriented and would move laterally in the water column rather than vertically to avoid a disturbance. Such disturbances would include waving your hand over the water, or throwing a pebble at the fish.

Elliott Bay

The increasing lengths of the juvenile salmon indicate that the fish were growing during the study period. Juvenile salmon were probably migrated directly from the Duwamish River and were passing through the area on their way to other feeding grounds. Weitkamp and Schadt (1982) in a beach seine study in the Smith Cove and Piers 90-91 area obtained similar results.

Juvenile salmonids were rarely sighted at locations other than in the intertidal zone. Tidal currents and wave action made visual observation difficult, however, salmonids were rarely seen even in sheltered locations. Weitkamp and Schadt (1982) found that the majority of the juvenile salmonids from the Duwamish River migrate around Alki Beach rather than Piers 90 and 91 and the Magnolia areas. This could explain the low number of juvenile salmonids observed and caught in this study.

The pier 90/91 and Magnolia Bluff area is rocky and exposed to wind and waves which create a high energy environment. Under these conditions, selection may favor organisms that can tolerate an exposed location. The types of food organisms that juvenile salmonids prefer, such as the small epibenthic crustaceans, can usually be found in more sheltered habitats located elsewhere in Puget Sound.

Greater numbers of juvenile salmonids were captured in beach seine sets during flood tides. An explanation for this might be that the fish moved offshore during ebb tides to avoid becoming stranded as the tide falls. Beach seining during flood tide probably optimized captures of juvenile salmonids. Nevertheless, the data should be considered skewed because of this.

Kingston

The observational technique used at Kingston was originally developed for the Everett Homeport study. However, several important differences exist between the sites which, reduces the applicability of the technique. First, fish at Everett were always in distinct schools, while at Kingston, fish schools were usually large, diffuse aggregations with no clear separation between schools. Estimating the abundance of fish under such conditions was difficult, and the ability to distinguish between 1000^s of fish and 10,000^s of fish was sometimes difficult. At times, an entire observational area had thousands of fish,. Another difference was vertical distribution of the fish. While they tended to be surface oriented at Everett, fish at Kingston were distributed from the surface to at least 1.5 m. Abundance estimates were difficult since fish deeper in the water column were not visible especially under adverse conditions. Another problem was that fish were not always associated with any given structure, such as a dock or shore, therefore, they were often out of visual range. In the first stages of the study, the presence of fish could often be determined only by the presence of jumping fish or their characteristic dimples at the surface, and estimates of numbers or density were impossible. Later in the study, the fish appeared at the surface less frequently, so large numbers of fish may have gone unnoticed.

Thus, overall, the visual observations at Kingston may give only limited information on relative abundance of the juvenile salmonids. These observations are probably more useful in identifying behavioral differences that exist between juvenile salmonids in area such as Everett, where there is considerable freshwater influx, and Kingston, where the fish are fully adapted to the marine environment (Table 5).

Elliott Bay

Juvenile salmonids did not appear to reside in the area of the pile driving activity. However, the densities of fish found at the Everett Homeport were not found at Elliott Bay. Weitkamp and Schadt (1982) found that the majority of the juvenile salmonids from the Duwamish River migrate around Alki Beach rather than Piers 90 and 91 and the Magnolia areas. This could explain the low number of juvenile salmonids observed and caught in this study.

The presence and/or absence of juvenile salmonids did not appear to be correlated with pile driving activities, based on fyke and beach seine sets Regardless of pile driving activity, juvenile salmonids were not observed in the vicinity of the pile driver, but they were routinely captured along shore. However, the amount of pile driving activity was relatively low at Elliott Bay compared to the Everett Homeport, for example. In addition, since the behavior of juvenile salmonids at Elliott Bay is virtually unknown, and because few fish were captured in beach seine and fyke net sites, conclusions regarding the impacts of pile driving on these fish at this site are sheer speculation.

Table 5. Summary Table of contrasts and comparisons of Everett Homeport and Kingston Ferry Terminal.

Parameter	**Everett**	**Kingston**
School density	High • less diffuse	Low • more diffuse
Reaction to disturbance	Lateral • horizontal	Vertical • dive
Fish size	Constant	Increasing
Offshore movement	No	Yes
Swim under floating objects	No	Yes
Vertical distribution in water column	Surface to <0.3 m	Surface to >1 m
Proximity to shore	Always (0-2 m)	Sometimes
Peak abundance	Last week of April to first week of May	Middle two weeks of May
Response to shade	Yes	Not clear
Salinity	Less saline at surface (11-26‰)	28‰ throughout water column
Temperature	8-12°C	11-12°C

DOES PILE DRIVING AFFECT FISH DISTRIBUTION AND BEHAVIOR?

Fish were not uniformly distributed at the Elliott Bay site. In contrast to the east beach experimental unit, the west beach experimental unit generally had fewer juvenile salmonids. Whether this phenomenon was correlated with construction activities is not known. In addition, fish apparently resided more in the intertidal zone rather than in more pelagic areas.

Everett

Outmigrating salmonids experience a variety of sensory stimuli when they encounter a pile driving site. However, certain stimuli may have greater significance than others. The primary concern behind the regulations restricting pile driving is that the sounds generated by pile driving underwater will disturb the fish. Visual disturbances are certainly another potential disturbance to consider. The differences observed in fish behavior and presence/absence may have been a result of the skiff and worker activity surrounding the rigs on pile driving days. However, this explanation does not apply to shoreline data since miscellaneous construction activity along shore was considered to be constant throughout this study, regardless of pile driving status. While the activity of construction workers along shore could not be quantified, it is reasonable to say that the activity was constant from day to day with such activities as cutting the tops of piles off, milling about in motor powered work skiffs, dropping items in the water, and pounding nails into concrete forms. However, there were gradual changes in the shoreline structure over time, since wooden and concrete structures were being extended out into the water in order to pour concrete for the main carrier pier. These types of gradual changes over time could not be accounted for in the context of this study, but still require consideration when examining the results of this study. Therefore, we assumed that sound and visual disturbances were the primary stimuli present at pile driving projects, and salmonids are certainly capable of detecting these stimuli.

Assuming juvenile pink and chum salmon found the sounds of pile driving aversive, fish schools in this study would be expected to ball-up, dive, polarize or swim away in response to the sounds of pile driving. Of these responses, polarized behavior was observed at the Homeport. However, differences in the behavior of fish in this study were evident over time. For example, fish schools would rarely polarize when a given pile driver started driving. Some schools were simply polarized, but the incidence of polarized behavior was higher on non-pile driving days compared to pile driving days on both rigs and the shoreline observations. The data changed as a function of pile driving during the day, but not if there was pile driving at the moment a school was observed.

The prevalence of fish schools at or near the surface where salinities were the lowest is consistent with other studies (Tyler 1963; Iwata 1980; Iwata et al. 1982; Iwata and Komatsu 1984; Irie 1985). Fish schools rarely would dive deeper than 1 m in the water column in response to disturbances such as a rock being thrown at them or a gull shadow passing over. Hoar (1951), noted diving and scattering behavior in pink and chum salmon fry in response to a hand wave. However, these fish were in freshwater. It is generally assumed that juvenile pink and chum salmon reside near the surface in the freshwater lens (10-14‰ salinity) at the mouth of a river because of osmotic stress (Iwata et al. 1982). As a result, they are apparently reluctant to dive into the water column in response to any aversive stimulus and "chose" to escape laterally instead.

A major concern of WDF was that fish would be driven offshore into the neritic zone in response to pile driving. Had this been the case, we would have expected fish schools to be less abundant on pile driving days, if not absent entirely. This did not occur along shore. However, fewer schools were observed around pile driving rigs on pile driving days compared to non-pile driving days. This difference could have been due to either pile driving or the associated activities (such as work skiffs) of pile driving. Fish schools that were observed along shore did not change their distance from shore, suggesting they were not being driven to deeper water. Since we relied on human observation for quantifying fish abundance, there is a possibility that fish schools were driven offshore, undetected by observers. We would estimate that schools >10 m from shore would not be visible to observers. Active hydroacoustics and purse seining would help answer that question.

Other studies have used humans for observation of fish schools, but met with limited success for various reasons. Schreiner et al. (1977), visually surveyed over 13 Km of shoreline by boat. Since schools are easily startled by boat movement, observation was difficult. In addition, observations were only possible on clear, sunny days, and the shear magnitude of shoreline to be observed was too much. Allen (1974), was also constrained by the same limitations. For this study, a short length of shore (488 m) was surveyed not from a boat, rather, observers walked slowly along shore in order to avoid startling the fish schools. Observation averaged 5-6 h each day, 5 days a week. In addition, fish schools were easily observed on overcast days.

Tidal stage did not appear to play a significant role in the abundance or behavior of fish in this study. While juvenile salmonids may alter their distributions vertically in the water column in response to salinity, this behavior could not be measured in this study. Migration from the Snohomish River was believed to be strongly correlated with tidal stage, but not with time of day according to Tyler (1963). However, Tyler was referring to fish in the river channel. The mole area at the Homeport did not have swift currents that could sweep fish away.

The ultimate question of whether or not pile driving has an impact on the fitness of juvenile pink and chum salmon cannot be answered based on the results of this study.

STUDY LIMITATIONS

Everett Homeport

This study was designed to test the feasibility of various methods to assess the impact of pile driving on juvenile salmonid distribution and behavior. There are no other studies to date that have examined this issue. While in some instances it is difficult to separate all of the factors contributing to fish behavior and ecology at the Homeport, we have tried to restrict the variability introduced by tidal stage, different observers, weather, and fish behavior.

Another limitation of this study is the disproportionate ratio of pile driving to non-pile driving days (too many pile driving days). Had there been an equal sample size, many of the variables such as tidal stage, time of day, cloud cover, and observer subjectivity would have been normalized. For example, most non-pile driving days had >50% cloud cover, hence, it was difficult to separate the effects of cloud cover and pile driving on fish behavior and/or observer perception of fish behavior. Nevertheless, there were many instances where fish behavior was affected by pile driving and/or its associated activities, when tidal stage, observer, weather, and time of day were accounted for.

The Everett Homeport is one site, studied for one season. The results of this study cannot necessarily be extrapolated to other sites where pile driving is occurring. For example, the juvenile pink and chum salmon considered for this study were newly emerged and apparently moving rapidly along shore. Juvenile pink and chum salmon at other sites that are not in close proximity to a river might move slowly through the area and be subject to perturbance from pile driving because of increased exposure time.

The majority of data collected for this study were based on human observation, which, has its limitations and biases. On windy or rainy days it was particularly difficult to observe fish schools. Each of the four observers had slightly different opinions concerning the size and behavior of any given school. Fish schools could have been deeper in the water column, or further from shore on pile driving days and this would not have been apparent to observers. The possibility that schools were deeper and hence not visible is not likely since Iwata et al. (1982) never saw chum salmon fry below the freshwater lens based on 5 years of underwater observations. In addition, other species of fish were observed deeper in the water column by observers in the study. Fish schools may also have avoided the site entirely on pile driving days and headed to deeper water of Port Gardner or the gently sloping beaches of Jetty Island.

Elliott Bay

The results gathered from the Elliott Bay Marina regarding the impacts of pile driving on juvenile salmonids are unreliable for a number of reasons. First, very few fish were captured and/or observed over the study period. This makes for small sample sizes on data that are inherently highly variable. Second, virtually nothing can be said about the behavior of juvenile salmonids in response to the perturbations from pile driving, since fish were never observed by humans. Third, a vibratory hammer was used to drive small steel I-beam type piles. It would be reasonable to say that juvenile salmonids might respond differently to the sounds of a vibratory hammer, compared to that of a diesel compression hammer.

Bremerton and Kingston

Since limited pile driving occurred at Bremerton when there were almost no fish present, nothing can be said about the impacts of pile driving on the ecology juvenile pink and chum salmon. All we can say with reasonable confidence was that juvenile pink and chum salmon were not present at the site in large numbers when pile driving occurred.

The Kingston site provided ample opportunity for observation and capture of juvenile pink and chum salmon. However, a pile was never driven at this site. Again, nothing can be said about the impacts pile driving might have on juvenile salmonids

SUMMARY

Based primarily on the results from the Everett Homeport, pile driving apparently has an impact on the distributions and behavior of juvenile pink and chum salmon (Fig. 42). We did not observe significant changes in overall fish abundance as a function of pile driving at the site. However, caution must be observed when interpreting this result, since it is based on a small sample size and on data that are inherently highly variable. However, fish appeared to change their distributions about the site, orienting and moving towards the acoustically isolated cove side of the site on pile driving days more than on non-pile driving days, and this result has more significance since it is not skewed by changes in fish abundance over time, or small data sets. There appear to be changes in general behavior and school size, as a function of pile driving, but again this result is based on highly variable data since there were so many variables that could affect the fish behavior, and/or perceived fish behavior by the observers. Fish were feeding well the day they were sampled about the rigs and along shore.

While any one variable that was measured in this study should not be considered by itself as an indicator of the impact pile driving has on juvenile salmonids, it would seem reasonable to consider all of the measured parameters as a whole. In doing this, we see a collection of results that indicate there is an impact from pile driving on juvenile Pacific salmon. Ultimately, it is difficult to ascertain the impact of pile driving noise on juvenile salmonid fitness. In order to answer this regulations imposed by WDF, further research would be necessary.

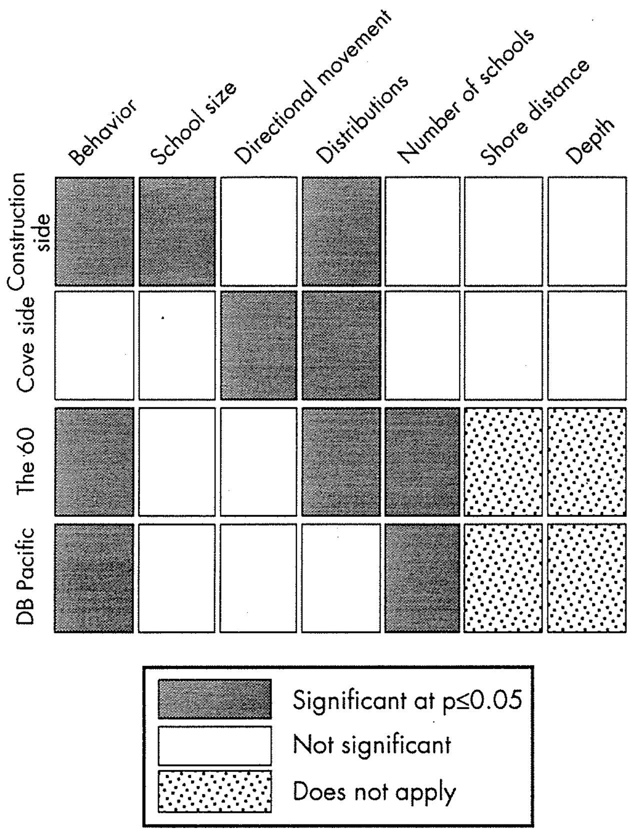


FIGURE 42. Summary figure of results from Everett Homeport. Behavior measured was passive mill, active mill, and polarized. School sizes were 10's, 100's, and 1000's. Direction of movement was north, east west, and south. Distributions were for each side of the mole, or various locations about each of the rigs. No. of schools was per round of the mole, or hour on each rig. Shore distance was in meters, and depth was depth of water fish schools were sighted in, in meters.

REFERENCES

Abbott, R.R. 1970. Hearing of salmonids with reference to the use of sound in fish culture. M.S. Thesis, Univ. of Washington, Seattle, WA. 48 p.

Abbott, R.R. 1973. Acoustic sensitivity of salmonids. Ph.D Thesis, Univ. of Washington, Seattle, WA. 113 p.

Allen, B. 1974. Early marine life history of Big Qualicum River chum salmon, p. 137-148. In D.R. Harding, [ed] Proceedings of the 1974 Northeast Pacific Pink and Chum Salmon Workshop - session IV.

Anderson, J.J. 1988a. Diverting migrating fish past turbines. NW. Environ. J. 4:109-128.

Anderson, J.J. 1988b. A computer model for fish trajectories at Rocky Reach Dam: Indications that fish avoid low frequency sound made by the submersible traveling screen, p. (2)31-50. *In* W.C. Micheletti, [ed.] Proceedings of the Electric Power Research Institute Conference on Fish Protection at Steam and Hydro Plants, San Francisco, Oct. 28-30, 1987. EPRI CS/EA/AP-5663-SR, March.

Banner, A., and M. Hyatt. 1973. Effects of noise on eggs and larvae of two estuarine fishes. Trans. Am. Fish. Soc. 1:134-136.

Bax, N.J. 1983. Early marine mortality of marked juvenile chum salmon (*Oncorhynchus keta*) released into Hood Canal, Puget Sound, Washington, in 1980. Can. J. Fish. Aquat. Sci. 40:426-435.

Bax, N.J., and C.J. Whitmus. 1981. Early marine survival and migratory behavior of juvenile chum salmon released from the Enetai Hatchery, Washington in 1980. Final Report, Fish. Res. Inst., Univ. of Washington, Seattle, WA. FRI-UW-8109. 48 p.

Bax, N.J., E.O. Salo, B.P. Snyder, C.A. Simenstad, and W.J. Kinney. 1978. Salmonid outmigration studies in Hood Canal. Univ. of Washington. FRI-UW-7819. 128 p.

Beauchamp, D.A. 1986. Snohomish River juvenile salmon outmigration study 1986. The Tulalip Tribe and R.W. Beck and Associates, Seattle, WA. Navy contract No. N62474-86-C-0991. 95 p.

Beauchamp, D.A., D.E. Pflug, and G. Lucchetti. 1987. Snohomish River juvenile salmon outmigration study 1987. The Tulalip Tribe and Northwest Enviro-Metric Services, Vashon, WA. Navy contract No. N62474-86-C-0991. 108 p.

Blaxter, J.H.S., E.J. Denton, and J.A.B. Gray. 1981a. Acoustico-lateralis system in clupeid fishes, p. 39-59. *In* R.R. Fay, [ed.] Hearing and Sound Communication in Fishes. Proc. Life Sci.

Blaxter, J.H.S, J.A.B. Gray, and E.J. Denton. 1981b. Sound and startle responses in herring shoals. J. Mar. Biol. Ass. U.K. 61:851-869.

Blaxter, J.H.S., and R.S. Batty. 1985a. Herring behavior in the dark: responses to stationary and continuously vibrating obstacles. J. Mar. Biol. Ass. U.K. 65:1031-1049.

Blaxter, J.H.S., and R.S. Batty. 1985b. The development of startle responses in herring larvae. J. Mar. Biol. Assn. 65:737-50.

Brett, J.R. 1952. Temperature tolerance in young Pacific salmon, genus Oncorhynchus. J. Fish. Res. Bd. Canada. 9(6):265-309.

Burner, C.J., and H.L. Moore. 1962. Attempts to guide small fish with underwater sound. U.S. Fish Wildl Ser., Spec. Sci. Rep. Fish. 403:1-30.

Campenhausen, C. von, I. Riess, and R. Weissert. 1981. Detection of stationary objects by blind cave fish *Anoptichthys jordani* (Characidae). J. Comp. Physiol. 143:369-374.

Chapman, C.J., and A.D. Hawkins. 1973. A field study of hearing in the cod, *Gadus morhua*. J. Comp. Physiol. 85:147-67.

Chapman, C.J., and O. Sand. 1974. Field studies of hearing in two species of flatfish, *Pleuronectes platessa* (L.) and *Limanda limanda* (L.). Comp. Biochem. Physiol. 47A:371-385.

Chitwood, S.A. 1981. Water quality, salmonid fish, smelt, crab and subtidal studies at the Quillayute River project. Rep. to Seattle Dist., U.S. Army Corps Engin., Quileute Fish. Dept., Quileute Indian Tribe, LaPush, WA. 92 p.

Congleton, J.L., S.K. Davis, and S.R. Foley. 1981. Distribution, abundance and outmigration timing of chum and chinook salmon fry in the Skagit salt marsh, p. 153-163. *In* E.L. Brannon, and E.O. Salo, [ed.] Proceedings of the Salmon and Trout Migratory Behavior Symposium, June 1981. University of Washington Press, Seattle, WA. 309 p.

Conley, R.L. 1977. Distribution, relative abundance, and feeding habits of marine and juvenile anadromous fishes of Everett Bay, Washington. M.S. Thesis, Univ. of Washington, Seattle, WA. 61 p.

Coombs, S., and A.N. Popper. 1979. Hearing differences among Hawaiian squirrelfish (family Holocentridae) related to differences in the peripheral auditory system. J. Comp. Physiol. 132A:203-207.

Cox, M., P.H. Rogers, A.N. Popper, and W.M. Saidel. 1987. Anatomical effects of intense tone stimulation in the goldfish ear: Dependence on sound-pressure level and frequency. J. Acoust. Soc. Am. 81(Supp. 1): S7

Driscoll, A.L. 1978. Snohomish Estuary wetlands study: Base information and evaluation. Shapiro and Associates Inc. U.S. Army Corps of Engineers contract No. DACW67-77-C-0103. 335 p.

Enger, P.S. 1981. Frequency discrimination in teleosts-central or peripheral?, p. 243-255. *In* W.N. Tavolga, A.N. Popper, and R.R. Fay, [ed.]. Hearing and Sound Communication in Fishes. Springer Verlag, New York, NY.

Fay, R.R. 1988. Hearing in mammals, p. 327. *In* R.R. Fay, [ed.] Hearing in Vertebrates: a Psychophysics Databook. Hill-Fay Associates, Winnetka, IL. 621 p.

Fay, R.R. 1988. Peripheral adaptations for spatial hearing in fish, p. 711-731. *In* J. Atema, R.R. Fay, A.N. Popper, and W.N. Tavolga, [ed.] Sensory Biology of Aquatic Animals. Springer-Verlag, New York. 936 p.

Fay, R.R., and S. Coombs. 1983. Neural mechanisms in sound detection and temporal summation. Hearing Research. 10:69-92.

Feller, R.J., and V.W. Kaczynski. 1975. Size selective predation by juvenile chum salmon (*Oncorhynchus keta*) on epibenthic prey in Puget Sound. J. Fish. Res. Board Can. 32:1419-1429.

Fletcher, R.I. 1985. Risk analysis of fish diversion experiments: pumped intake systems. Trans. Am. Fish. Soc. 111:652-694.

Fresh, K.L., D. Rabin, C.A. Simenstad, E.O. Salo, K.Garrison, and L. Matheson. 1979. Fish ecology studies in the Nisqually Reach area of southern Puget Sound, Washington. Fish. Res. Inst., Univ. of Washington. FRI-UW-7904. 229 p.

Foerster, R.E. 1968. The sockeye salmon, *Oncorhynchus nerka*. Bull. Fish. Res. Bd. Can. 162:422 p.

Furnell, D.J., and J.R. Brett. 1986. Model of monthly marine growth and natural mortality for Babine Lake sockeye salmon (*Oncorhynchus nerka*). Can. J. Fish. Aquat. Sci. 43:999-1004.

Gilhousen, P. 1962. Marine factors affecting the survival of Fraser River pink salmon, p. 105-111. *In* Symposium on Pink Salmon. H.R. MacMillan Lectures in Fisheries, Univ. British Columbia, Vancouver, B.C.

Godfrey, H. 1958. Comparisons of the index of return for several stocks of British Columbia salmon to study variations in survival. J. Fish. Res. Bd. Can. 15:891-908.

Godin, J.-G.J. 1981. Daily patterns of feeding behavior, daily rations, and diets of juvenile pink salmon (*Oncorhynchus gorbuscha*) in two marine bays of British Columbia. Can. J. Fish. Aquat. Sci. 38(1):10-15.

Godin, J.-G.J. 1982. Migrations of salmonid fishes during early life history phases: daily and annual timing. p. 22-50. *In* E.L. Brannon, and E.O. Salo, [ed.] Proceedings of the Salmon and Trout Migratory Behavior Symposium, June 1981. University of Washington Press, Seattle, WA. 309 p.

Gosho, M.E. 1977. The food and feeding habits of juvenile pink salmon in the estuaries of Kodiak Island, Alaska. Masters Thesis, University of Washington. 87pp.

Groot, C. 1982. Modifications on a theme-a perspective on migratory behavior of Pacific salmon, p. 1-21. *In* E.L. Brannon, and E.O. Salo, [ed.] Proceedings of the Salmon and Trout Migratory Behavior Symposium, June 1981. University of Washington Press, Seattle, WA.

Hargreaves, N.B., and R.J. LeBrasseur. 1985. Species selective predation on juvenile pink (*Oncorhynchus gorbuscha*) and chum salmon (*O. keta*) by coho salmon (*O. kisutch*). Can. J. Fish. Aquat. Sci. 42(4):659-668.

Hasegawa, S., T. Hirano, T. Ogasawara, M. Iwata, T. Akiyama, and S. Arai. 1987. Osmoregulatory ability of chum salmon, *Oncorhynchus keta*, reared in freshwater for prolonged periods. Fish Physiol. Biochem. 4(2):101-110.

Hashimoto, T., and Y. Maniwa. 1966. Research on the luring of fish shoals by utilizing underwater acoustical equipment. Proc. Symp. Mar. Bio-Acoust. 2:93-104

Hawkins, A.D. 1986. Underwater sound and fish behavior. p.114-151 *In* T.J. Pitcher, [ed.] The Behavior of Teleost Fishes. Johns Hopkins University Press, Maryland.

Hawkins, A.D., and D.N. MacLennan. 1976. An acoustic tank for acoustic studies on fish. p.149-169 *In* A. Schuijf, and A.D. Hawkins, [ed.] Sound Reception in Fish. Elsevier, Amsterdam.

Hawkins, A.D., and A.D.F. Johnstone. 1978. The hearing of Atlantic Salmon, *Salmo salar*. J. Fish. Biol. 13:655-673.

Haymes, G.T., and P.H. Patrick. 1986. Exclusion of adult alewife, *Alosa pseudoharengus*, using low-frequency sound for application at water intakes. Can. J. Fish. Aquat. Sci. 43:855-862.

Healey, M.C. 1979. Detritus and juvenile salmon production in the Nanaimo estuary: I. Production and feeding rates of juvenile chum salmon (*Oncorhynchus keta*). J. Fish. Res. Board Can. 36:488-496.

Healey, M.C. 1982a. Timing and relative intensity of size-selective mortality of juvenile chum salmon (*Oncorhynchus keta*) during early sea life. Can. J. Fish. Aquat. Sci. 39:952-957.

Healey, M.C. 1982b. Juvenile Pacific salmon in estuaries: the life support system. p. 315-341. *In* V.S. Kennedy, [ed.] Estuarine Comparisons. Academic Press, Toronto, Ont. 709 p.

Herring, G. 1968. Avoidance of acoustic stimuli by the herring. Int. Counc. Explor. Sea C.M. (H 18). 8 p.

Hoar, W.S. 1951. The behavior of chum, pink and coho salmon in relation to their seaward migration. J. Fish. Res. Bd. Can. 8(4):241-263.

Irie, T. 1985. Occurence and distribution of offshore migrating juvenile chum salmon along the Pacific Coast of Northern Japan. Bull. Jap. Soc. Sci. Fish. 51(5):749-754.

Irie, T. 1987. Ecological studies on juvenile chum and pink salmon in their early marine life - V. Feeding habits and prey size of juvenile chum salmon in small harbours in eastern Hokkaido. Bull. Hokk. Reg. Fish. Lab. 51:1-10.

Irie, T., T. Kobayashi, and M. Osako. 1981. Ecological studies on juveniles of chum and pink salmon during early ocean residence - I. Distribution and behavior of the juveniles in Abashiri Bay and adjacent waters. Bull. Hokkaido Reg. Fish. Res. Lab. 46:15-36.

Irie, T., and K. Nakamura. 1985. Ecological studies on juvenile chum and pink salmon in their early marine life-IV. The residence and growth of juvenile chum salmon in small harbours of eastern Hokkaido. Bull. Hokkaido. Reg. Fish. Res Lab. 50:13-25.

Irie, T., T. Kobayashi, and M. Osako. 1981. Ecological studies on juveniles of chum and pink salmon during early ocean residence - I. Distribution & behavior of the juveniles in Abashiri Bay and adjacent waters. Bull. Hokkaido Reg. Fish. Res. Lab. 46:15-36.

Iwata, M. 1980. Downstream migration and seawater adaptability of chum salmon (*Oncorhynchus keta*) fry. Proc. North Pacific Aquaculture Symp. 1980. p. 51-59.

Iwata, M. and S. Komatsu. 1984. Importance of estuarine residence for adaptation of chum salmon (*Oncorhynchus keta*) fry to seawater. Can. J. Fish. Aquat. Sci. 41:744-749.

Iwata, M., T. Hirano, and S. Hasegawa. 1982. Behavior and plasma sodium regulation of chum salmon fry during transition into seawater. Aquaculture. 28:133-142.

Kaczynski, V.W., R.J. Feller, J. Clayton, and R.J. Gerke. 1973. Trophic analysis of juvenile pink and chum salmon (*Oncorhynchus gorbuscha* and *O. keta*) in Puget Sound. J. Fish. Res. Board Can. 30:1003-1008.

Kalmijn, Ad. J. 1988. Hydrodynamic and acoustic field detection, p. 83-130. *In* J. Atema, R.R. Fay, A.N. Popper, and W.N. Tavolga, [ed.] Sensory Biology of Aquatic Animals. Springer-Verlag, New York.

Kirkwood, J.B. 1962. Inshore-marine and freshwater life history of pink salmon, *Oncorhynchus gorbuscha* (Walbaum), and the chum salmon, *O. keta* (Walbaum), in Prince William Sound, Alaska. Ph.D. Thesis, Univ. Louisville, KY. 300 p.

Kobayashi, T., and S. Abe. 1977. Studies on the Pacific salmon in the Yurappu River and Volcano Bay. 2. On the migration and the growth of pink salmon fry, *Oncorhynchus gorbuscha* (Walbaum), during seaward migration. Sci. Rep. Hokkaido salmon Hatchery. 20:1-10.

Konagaya, T. 1980. Jumping response of ayu to sound. Bull. Japan. Soc. Sci. Fish. 46(1):31-34.

Koshiishi, Y. 1980. Rate of gastric evacuation in juvenile chum salmon, *Oncorhynchus keta*. Bull. Jap. Sea Reg. Fish. Res. Lab. 31:161-164.

Koshiishi, Y. 1986. Effect of salinity on food intake, growth and feed efficiency of chum salmon, *Oncorhynchus keta* (Walbaum), and ayu, *Plecoglossus altivelis*. Temminck et Schlegel. Bull. Jap. Sea Reg. Fish. Res. Lab. 36:1-14.

Ladich, F. 1988. Sound production by the gudgeon, *Gobio gobio* L., a common European freshwater fish (Cyprinidae, Teleostei). J. Fish Bio. 32(5):707-715.

LeBrasseur, R.J. 1969. Growth of juvenile chum salmon (*Oncorhynchus keta*) under different feeding regimes. J. Fish. Res. Board Can. 26:1631-1645.

LeBrasseur, R.J., and R.R. Parker. 1964. Growth rate of central British Columbia pink salmon. J. Fish. Res. Board Can. 21:1101-1128.

Levings, C.D., C.D. McAllister, J.S. Macdonald, T.J. Brown, M.S. Kotyk, and B.A. Kask. 1989. Chinook salmon (*Oncorhyncus tshawytscha*) and estuarine habitat: a transfer experiment can help evaluate estuary dependency, p. 116-122. *In* C.D. Levings, L.B. Holtby, and M.A. Henderson, [ed.] Proceedings of the National Workshop on Effects of Habitat Alteration on Salmonid Stocks. Can. Spec. Publ. Fish. Aquat. Sci. 105.

Levy, D.A. and T.G. Northcote. 1982. Juvenile salmon residency in a marsh area of the Fraser River Estuary. Can. J. Fish. Aquat. Sci. 39: 270-276.

Manzer, J.I. 1956. Distribution and movement of young Pacific salmon during early ocean residence. Fish. Res. Board Can. Prog. Rep. 106:24-28.

Manzer, J.I., and M.P. Shepard. 1962. Marine survival, distribution and migration of pink salmon (*Oncorhynchus gorbuscha*) off the British Columbia coast, p.113-122. *In* N.J. Wilimovsky, [ed] Symposium on Pink Salmon, H.R. Macmillan Lectures in Fisheries. Institute of Fisheries, UBC.

Mason, J.C. 1974. Behavioral ecology of chum salmon (*Oncorhynchus keta*) in a small estuary. J. Fish. Res. Board Can. 31:83-92.

McEntee, D.M., T.H. Schadt, and D.E. Weitkamp. 1985. Juvenile salmonid study Everett Harbor, 1984. Department of the Navy and Parametrix, Inc. Bellevue, WA. Document No. 85-0225-0008 F- 55-1586-01(4). 32 p.

McKinley, R.S., and P.H. Patrick. 1986. Use of behavioural stimuli to divert sockeye salmon smolts at the Seton Hydro-electric Station, British Columbia, p (4-53)-(4-63). *In* W.C. Micheletti, [ed.] Proceedings of the Electric Power Research Institute Conference on Fish Protection at Steam and Hydro Plants, San Francisco, Oct. 28-30, 1987. EPRI CS/EA/AP-5663-SR, March.

Meier, A.H., and N.D. Horseman. 1977. Stimulation and depression of growth, fat storage, and gonad weight by daily stimulus in the teleost fish, *Tilapia aurea*. 8th Annual Meeting, World Maricult. Soc. p 135-143.

Meyer, J.H., T.A. Pearce, and S.B. Patlan. 1981. Distribution and food habits of juvenile salmonids in the Duwamish Estuary. U.S. Fish and Wildlife Service, FAO. Olympia, WA.

Moore, H. L., and H. W. Newman. 1956. Effects of sound waves on young salmon. U.S. Fish Wildlife Serv. Spec. Sci. Report: 172. 19 p.

Moorehouse, V.H.K. 1932. Do fish react to noise? Biol. Bd. Can. Prog. Rep. 13 Pac. Biol. Stat. p. 14-15.

Mortensen, D., J. Landingham, A. Wertheimer, and S. Taylor. 1991. Relationship of early marine growth and survival of juvenile pink salmon to marine water temperature and secondary production in Auke Bay, Alaska. *In* Proceedings of the NE Pacific Pink and Chum Salmon Symp. In Press.

Moulton, J.M. 1956. The movements of menhaden and butterfish in a sound field. Anat. Rec. 125:592.

Myrberg, A.A. 1972. Using Sound to Influence the Behavior of Free-Ranging Marine Animals, pp 435-468. *In* J.E. Winn, and B.L. Olla, [ed.] Behavior of Marine Animals, vol. 2. Plenum, New York.

Myrberg, A.A., and R.J. Riggio. 1985. Acoustically mediated individual recognition by a coral reef fish (*Pomacentrus partitus*). Anim. Behav. 33:411-416.

Neave, F. 1966. Pink salmon in British Columbia. *In* Salmon of the North Pacific Ocean - Part III, a Review of the Life History of North Pacific Salmon. Int. N. Pac. Fish. Comm. Bull. 18:73.

Nelson, D.R. 1965. Hearing and the acoustic orientation in the lemon shark, *Negaprion brevirostris* (Poey), and other large sharks. Diss. Abstracts. Zoology. 333-B.

Nelson, D.R., R.H. Johnson, and L.G. Waldrop. 1969. Responses in Bahamian sharks and groupers to low-frequency, pulsed sounds. Bull. S. Calif. Acad. Sci. 68(3):131-137.

Nomura, M. 1980. Influence of fish behavior on use and design of setnets, p. 446-471. *In* J.E. Bardach, J.J. Magnuson, R.C. May, and J.M. Reinhart, [ed.] Fish Behavior and its Use in the Capture and Culture of Fishes. ICLARM, Phillipines.

Olsen, K. 1969. Directional responses in herring to sound and noise stimuli. Counc. Meet. Int. Counc. Explor. Sea (B20). 8 p.

Olsen, K. 1971. Influence of vessel noise on behavior of herring. FAO Rep FFI/70/63. 7 p.

Olsen, K. 1976. A comparison of acoustic threshold in cod with recordings of ship-noise, p 431-451. *In* Effects of Power Peaking on the Survival of Juvenile Fish at the Lower Columbia. US Army Corps Eng. North Pac. Div.

Ona, E., and R. Toresen. 1988. Reactions of herring to trawling noise. Internat. Coun. Explor. Sea. Fish Cap. Comm. C.M. 1988/B:36 Session P. 8 p.

Parker, R.R. 1968. Marine mortality schedules of pink salmon of the Bella Coola River, Central British Columbia. J. Fish. Res. Bd. Can. 25(4): 757-794.

Parker, R.R. 1971. Size selective predation among juvenile salmonid fishes in a British Columbia inlet. J. Fish. Res. Bd. Can. 28: 1503-1510.

Parsons, T.R., and R.J. LeBrasseur. 1970. The availability of food to different trophic levels in the marine food chain, p.325-343. *In* J.H. Steele, [ed.] Marine Food Chains. Edinburgh: Oliver and Boyd.

Peterman, R.M. 1982. Nonlinear relation between smolts and adults in Babine Lake sockeye salmon (*Oncorhynchus nerka*) and implications for other salmon populations. Can. J. Fish. Aquat. Sci. 39:904-913.

Phillips, A.C. 1977. Key field characteristics of use in identifying young marine Pacific salmon. Fish. Mar. Serc. Tech. Rpt. 746. 13 p.

Phillips, A.C., and W.E. Barraclough. 1978. Early marine growth of juvenile Pacific salmon in the Strait of Georgia and Saanich Inlet, British Columbia. Can. Fish. Mar. Serv. Tech. Rep. 830.

Platt, C., and A.N. Popper. 1981. Fine structure and function of the ear, p. 3-71. *In* W.N. Tavolga, A.N. Popper, and R.R. Fay, [ed.] Hearing and Sound Communication in Fishes. Springer-Verlag, New York.

Popper, A.N., and N.L. Clarke. 1976. The auditory system of the goldfish (*Carassius auratus*): effects of intense acoustic stimulation. Comp. Biochem. Physiol. 53:11-18.

Richard, J.D. 1968. Fish attraction with pulsed low frequency sound. J. Fish. Res. Bd. Can. 25(7):1441-1452.

Ricker, W.E. 1962. Regulation of the abundance of pink salmon populations, p. 155-211. *In* N.J. Wilimovsky, [ed.] Symposium on Pink Salmon, H.R. Macmillan Lectures in Fisheries. Institute of Fisheries, UBC.

Ricker, W.E. 1976. Review of the rate of growth and mortality of Pacific salmon in salt water, and noncatch mortality caused by fishing. J. Fish. Res. Bd. Can. 33:1483-1524.

Rogers, P.H., and M. Cox. 1988. Underwater sound as a biological stimulus, p. 131-149. *In* J. Atema, R.R. Fay, A.N. Popper, and W.N. Tavolga, [ed.] Sensory Biology of Aquatic Animals. Springer-Verlag, New York.

Saidel, W.M., and A.N. Popper. 1987. Sound reception in two anabantid fishes. Comp. Biochem Physiol. 88A(1):37-44.

Salo, E.O., N.J. Bax, T.E. Prinslow, C.J. Whitmus, B.P. Snyder, and C.A. Simenstad. 1980. The effects of construction of naval facilities on the outmigration of juvenile salmonids from Hood Canal, Washington. Final Rep., Fish. Res. Inst., Univ. of Washington, Seattle, WA. FRI-UW-8006. 159 p.

Schadt, T.H., and D.E. Weitkamp. 1985. Juvenile salmonid stomach content study. Department of the Navy and Parametrix, Inc. Bellevue, WA. Document No. 85-0220-0007D 55-1586-02(4). 32 p.

Schreck, C.B. 1981. Parr-smolt transformation and behavior, p 164-172. *In* E.L. Brannon, and E.O. Salo, [ed.] Salmon and Trout Migratory Behavior Symposium. Univ. Washington School of Fisheries. Seattle, WA.

Schreck, C.B. 1982. Stress and the rearing of salmonids. Aquaculture. 28:241-249.

Schreffler, D.K., C.A. Simenstad, and R.M. Thom. 1990. Temporary residence by juvenile salmon in a restored estuarine wetland. Can. J. Fish. Aquat. Sci. 47:2079-2084.

Schreiner, J.U., E.O. Salo, B.P. Snyder, and C.A. Simenstad. 1977. Salmonid outmigration studies in Hood Canal-Final report, phase II. Fish. Res. Inst., Univ. of Washington, Seattle, WA. FRI-UW-7715.

Schwarz, A.L., and G.L. Greer. 1984. Responses of Pacific herring, *Clupea harengus pallasi*, to some underwater sounds. Can. J. Fish. Aquat. Sci. 41:1183-1192.

Simenstad, C.A., and W.J. Kinney. 1978. Trophic relationships of outmigrating chum salmon in Hood Canal, Washington, 1977. Fish. Res. Inst., Univ. of Washington, FRI-UW-7810. 75 p.

Simenstad, C.A., and D.M. Eggers [ed.]. 1981. Juvenile salmonid baitfish distribution, abundance, and prey resources in selected areas of Grays Harbor, Washington. Final Rep. to Seattle dist., U.S. Army Corps Engin., Fish. Res. Inst., Univ. of Washington, Seattle, WA. FRI-UW-8116. 205 p.

Simenstad, C.A., K.L. Fresh, and E.O. Salo. 1982. The role of Puget Sound and Washington coastal estuaries in the life history of Pacific salmon: an unappreciated function, p. 343-364. *In* V.S. Kennedy, [ed.] Estuarine Comparisons. Academic Press, Toronto, Ont. 709 p.

Stober, Q.T. 1969. Underwater noise spectra, fish sounds and response to low frequencies of cutthroat trout (*Salmo clarki*) with reference to orientation and homing in Yellowstone Lake. Trans. Am. Fish. Soc. 4:652-663

Sturdevant, M., A. Celewycz, M. Pritchett, and A. Wertheimer. 1991. Distribution, size and feeding habits of juvenile pink salmon in nearshore habitats of northwestern Prince William Sound. *In* Proceedings of the NE Pacific Pink and Chum Salmon Symp. In Press.

Tavolga, W.N. 1980. Hearing and sound production in fishes in relation to fisheries management, p. 102-123. *In* J.E. Bardach, J.J. Magnuson, R.C. May, and J.M. Reinhart, [ed.] Fish Behavior and It's Use in the Capture and Culture of Fishes. ICLARM, Philippines.

Tavolga, W.N., and J. Wodinsky. 1963. Auditory capacities in fish. Pure tone thresholds in nine species of marine teleosts. Bull. Am. Museum Nat. Hist. 126:177-239.

Thomas, R.E., J.A. Gharrett, M.G. Carls, S.D. Rice, A. Moles, and S. Korn. 1986. Effects of fluctuating temperature on mortality, stress, and energy reserves of juvenile coho salmon. Trans. Am. Fish. Soc. 115:52-59.

Tyler, R.W. 1963. Distribution and migration of young salmon in Everett Harbor, 1962. Final Report, Contract-Everett Bay Studies, Univ. of Washington Fisheries Research Institute, UW-FRI Report.

VanDerwalker, J.G. 1967. Response of salmonids to low frequency sound, p. 45-58. *In* W.N. Tavolga, [ed.] Marine Bio-acoustics, Vol. II. Pergamon Press, Oxford.

Volk, E.C., R.C. Wissmar, C.A. Simenstad, and D.M. Eggers. 1984. Relationship between otolith microstructure and the growth of juvenile chum salmon (*Oncorhynchus keta*) under different prey rations. Can. J. Fish. Aquat. Sci. 41:126-133.

Wardle, C.S. 1983. Fish reactions to Towed fishing gears, p.167-195. *In* A. Macdonald, and I.G. Priede, [ed.] Experimental Biology at Sea. Academic Press, New York.

Weissert, R., and C. von Campenhausen. 1981. Discrimination between stationary objects by the blind cave fish *Anopichthys jordani* (Characidae). J. Comp. Physiol. 143:375-381.

Weitkamp, D.E., and T.H. Schadt. 1982. 1980 Juvenile salmonid study, Port of Seattle, Washington. Report to Port of Seattle, Seattle, WA. Prepared by Parametrix Inc., Bellevue, WA.

Wisby, W.J., J.D. Richard, D.R. Nelson, and S.H. Gruber. 1964. Sound perception in elasmobranchs, p. 255-268. *In* W.N. Tavolga, [ed.] Marine Bio-acoustics. Pergamon Press, New York.

Wood, C.C. 1987a. Predation of juvenile Pacific salmon by the common merganser (*Mergus merganser*) on eastern Vancouver Island I: Predation during the seaward migration. Can. J. Fish. Aquat. Sci. 44:941-949.

Wood, C.C. 1987b. Predation of juvenile Pacific salmon by the common merganser (*Mergus merganser*) on eastern Vancouver Island II: Predation of stream-resident juvenile salmon by merganser broods. Can. J. Fish. Aquat. Sci. 44: 950-959.

GLOSSARY

dB: Decibel. The unit of sound measurement defined as 20 times the log of the product of the sound pressure being measured times the inverse of the reference pressure.

SPL: Sound pressure level.

TL: Total length of a fish, defined by the distance from the tip of the snout to the trailing edge of the caudal fin.

FL: Fork length of a fish, defined by the distance from the tip of the snout to the fork of the caudal fin.

WDF: Washington Department of Fisheries

Acoustico-lateralis system: The lateral line system and inner ear of fishes.

Cochlea: A small, spiral shaped, bony tube found within each of the paired inner ears of terrestrial vertebrates where the sensory hair cells are located.

Emergence: The time in a Pacific salmon's life history when juveniles emerge from the gravel after yolk sac absorption.

Epibenthic invertebrates: Invertebrates that inhabit the surface of submerged substrates in an estuary.

Habituation: A type of learning in organisms whereby repeated exposure to a given stimulus yields decreased behavioral response over time.

Nauplii: Lifestage in many groups of larval *Crustacea*, characterized by 3 pairs of appendages and a single median eye.

Nearshore zone: Oceanographic term describing the area between the shore and the surf zone.

Neritic zone: Oceanographic term describing the zone extending from low tide level to a depth of about 183 m.

Particle displacement: The component of sound that is the to-and-fro movement (on the order of nanometers) of water molecules, and is a vector quantity.

Pelagic invertebrates: Invertebrates that are free-swimming and inhabit open waters of the estuary.

Sound pressure: The component of sound that is the oscillatory change in pressure above and below hydrostatic pressure, and is a scalar quantity acting in all directions.

Startle response: A reflex response of organisms to a stimulus in which the organism darts suddenly and for short duration in order to escape the stimuli.

Sublittoral zone: Oceanographic term describing the zone extending from low tide level to a depth of about 21 m.

APPENDIX 1A: SHORELINE RAW DATA

J.D................ Julian date
ID .... Observer: BF=Blake Feist, LS=Liam Stacey, LC=Lori Christensen, KK=Kevin Kumagai
Round........... Yes is a complete round about the whole mole and the 14 zones, no is not a complete round
Start .... Time when observation of a given school was initiated
Stop .... Time when observation of a given school was terminated
AM/PM......... Time, classified as before or after 1300 hrs
T.Stg .... Tide stage classification as ebb or flood
Tide .... Tide elevation (m)
Wave .... Estimated wave height (m)
Wd.............. Estimated wind velocity (km/h)
—> .... Estimated wind direction (north, east, west, or south)
Rain .... Yes or no
Air .... Ambient air temperature (°C)
Clds .... Estimated cloud cover (%)
Clds 2 .... Estimated cloud cover as > or < 50%
DB State .... All is pile driving, none is total shutdown (non-pile driving days), standby is operational but not driving at the moment
60 State .... All is pile driving, none is total shutdown (non-pile driving days), standby is operational but not driving at the moment
Drive .... Yes is pile driving day, no is non-pile driving day
DB Pile......... Estimated school distance from DB pile being driven
60 Pile......... Estimated school distance from 60 pile being driven
DB Sh .... Distance that DB Pacific rig was from shore
60 Sh........... Distance that The 60 rig was from shore
DB-Z .... Which of the 14 zones the DB Pacific rig was in
60-Z .... Which of the 14 zones The 60 rig was in
Obs' .... Amount of time spent observing school (minutes)
#'s............... Estimated size of school (10's, 100's, or 1,000's)
Actual .... Estimated actual number of fish in school
Zone .... Which of the 14 zones the school was sighted in
Area .... Cons=construction side (noisy) of mole, cove=cove side (quiet) of mole
Depth .... Estimated depth of water school was observed in (m)
Shore .... Estimated distance from shore school was observed in (m)
Behav .... Fish school behavior where Pa mill=passive mill, Act mill=active mill and Polar=polarized
Behav Dir .... Direction of movement (if any) of school (north, south, east, west. or stationary)
Behav Dir 2 .... Direction of movement (if any) of school (east, west. or unknown/stationary)

J.D.	ID	Round	Start	Stop	AM/PM	T. Stg	Tide	Wave	Wd	—>	Rain	Air	Clds	Clds 2	DB State	60 State	Drive	DB Pile	60 Pile	DB Sh	60 Sh	DB -Z	60-Z	Obs'	#'s	Actual	Zone	Area	Depth	Shore	Behav	Behav Dir	Behav Dir 2
89	BF	No	1100	•	Before 1300	Ebb	0.61	0.00	0	•	No	•	90	>50%	All	All	Yes	•	•	•	•	•	•	2	2	•	13	Cove	•	•	Polar	West	West
90	BF	No	1050	1100	Before 1300	Ebb	•	0.00	0	•	No	•	100	>50%	None	None	No	•	•	•	•	•	•	10	3	•	9	Cove	4.57	6.10	Pa mill	Unknown/stat	Unknown/stat
90	BF	No	1125	1130	Before 1300	Ebb	•	0.00	0	•	No	•	100	>50%	None	None	No	•	•	•	•	•	•	5	3	•	9	Cove	4.57	6.10	Pa mill	Unknown/stat	Unknown/stat
90	BF	No	1118	1120	Before 1300	Ebb	•	0.00	0	•	No	•	100	>50%	None	None	No	•	•	•	•	•	•	2	2	•	5	Cons	1.83	3.05	Act mill	West	West
90	BF	No	1125	1130	Before 1300	Ebb	•	0.00	0	•	No	•	100	>50%	None	None	No	•	•	•	•	•	•	5	3	•	9	Cove	4.57	6.10	Pa mill	Unknown/stat	Unknown/stat
90	BF	No	1055	1056	Before 1300	Ebb	•	0.00	0	•	No	•	100	>50%	None	None	No	•	•	•	•	•	•	1	3	•	9	Cove	4.57	4.57	Polar	East	East
90	BF	No	1112	1115	Before 1300	Ebb	•	0.00	0	•	No	•	100	>50%	None	None	No	•	•	•	•	•	•	3	3	•	5	Cons	0.91	3.66	Act mill	Unknown/stat	Unknown/stat
90	BF	No	1050	1100	Before 1300	Ebb	•	0.00	0	•	No	•	100	>50%	None	None	No	•	•	•	•	•	•	10	3	•	9	Cove	4.57	6.10	Pa mill	Unknown/stat	Unknown/stat
91	BF	No	1815	1820	After 1300	Flood	•	0.00	0	•	No	•	40	<50%	None	None	No	•	•	•	•	•	•	5	3	•	6	Cons	1.22	3.05	Pa mill	Unknown/stat	Unknown/stat
91	BF	No	1752	1758	After 1300	Flood	•	0.00	0	•	No	•	40	<50%	None	None	No	•	•	•	•	•	•	6	3	•	9	Cove	6.10	7.62	Pa mill	Unknown/stat	Unknown/stat
91	BF	No	1802	1804	After 1300	Flood	•	0.00	0	•	No	•	40	<50%	None	None	No	•	•	•	•	•	•	2	2	•	8	Cove	1.83	1.52	Polar	South	East
91	BF	No	1752	1758	After 1300	Flood	•	0.00	0	•	No	•	40	<50%	None	None	No	•	•	•	•	•	•	6	3	•	9	Cove	6.10	7.62	Pa mill	Unknown/stat	Unknown/stat
91	BF	No	1806	1811	After 1300	Flood	•	0.00	0	•	No	•	40	<50%	None	None	No	•	•	•	•	•	•	5	3	•	8	Cove	0.91	1.52	Polar	South	East
92	BF	No	1632	1634	After 1300	Ebb	-0.18	0.00	0	•	No	•	10	<50%	Standby	Standby	Yes	•	•	•	•	•	•	2	3	•	14	Cove	2.44	3.05	Pa mill	Unknown/stat	Unknown/stat
92	BF	No	1628	1630	After 1300	Ebb	-0.15	0.00	0	•	No	•	10	<50%	Standby	Standby	Yes	•	•	•	•	•	•	2	3	•	3	Cons	1.52	6.10	Act mill	Unknown/stat	Unknown/stat
92	BF	No	1623	1624	After 1300	Ebb	-0.12	0.00	0	•	No	•	10	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	2	200	5	Cons	0.61	2.44	Polar	East	East
92	BF	No	1623	1624	After 1300	Ebb	-0.12	0.00	0	•	No	•	10	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	2	200	5	Cons	0.61	2.44	Polar	East	East
92	BF	No	1620	1622	After 1300	Ebb	-0.12	0.00	0	•	No	•	10	<50%	Standby	Standby	Yes	•	•	•	•	•	•	2	3	•	6	Cons	0.91	3.05	Pa mill	Unknown/stat	Unknown/stat
92	BF	No	1614	1615	After 1300	Ebb	0.00	0.00	•	•	No	•	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	2	•	9	Cove	0.61	0.91	Act mill	East	East
92	BF	No	1612	1613	After 1300	Ebb	0.00	0.00	•	•	No	•	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	3	•	9	Cove	0.61	3.05	Pa mill	Unknown/stat	Unknown/stat
92	BF	No	1427	1430	After 1300	Ebb	0.91	•	•	•	No	•	50	>50%	Standby	Standby	Yes	•	•	•	•	•	•	3	3	•	14	Cove	0.61	3.05	Pa mill	Unknown/stat	Unknown/stat
94	BF	No	1030	1031	Before 1300	Flood	1.98	0.00	•	•	No	•	0	<50%	Standby	Standby	Yes	•	•	160	20	5	3	1	3	1000	1	Cons	•	•	Polar	Unknown/stat	Unknown/stat
94	BF	No	1043	1112	Before 1300	Flood	2.13	0.00	•	•	No	•	0	<50%	All	All	Yes	100	160	160	20	5	3	29	2	•	5	Cons	0.91	3.05	Act mill	West	West
94	BF	No	1053	1054	Before 1300	Flood	2.13	0.00	•	•	No	•	0	<50%	All	All	Yes	150	100	160	20	5	3	1	1	•	5	Cons	3.05	6.10	Polar	East	East
95	BF	No	1047	1050	Before 1300	Flood	•	0.00	0	•	No	•	•	•	None	None	No	•	•	180	20	5	2	3	3	•	5	Cons	•	3.66	Act mill	East	East
96	BF	No	1530	1531	After 1300	Ebb	2.65	0.00	•	•	No	•	0	<50%	All	All	Yes	•	•	180	60	•	5	1	3	5000	9	Cove	0.91	0.91	Pa mill	Unknown/stat	Unknown/stat
101	BF	No	1523	1524	After 1300	Flood	0.09	0.00	•	•	No	•	50	>50%	Standby	Standby	Yes	•	•	200	40	5	4	1	3	•	9	Cove	0.91	3.05	Act mill	West	West
101	BF	No	1232	1233	Before 1300	Flood	0.15	0.00	•	•	No	•	•	•	Standby	Standby	Yes	•	•	200	40	5	4	1	2	•	9	Cove	•	•	Pa mill	Unknown/stat	Unknown/stat
101	BF	No	1219	1220	Before 1300	Ebb	0.15	0.00	•	•	No	•	•	•	Standby	Standby	Yes	•	•	200	40	5	4	1	2	•	6	Cons	0.31	3.05	Pa mill	Unknown/stat	Unknown/stat
101	BF	No	1456	1502	After 1300	Flood	0.76	0.00	•	•	No	•	50	>50%	All	All	Yes	•	•	220	40	5	4	6	3	•	14	Cove	0.61	1.83	Polar	South	East
101	BF	No	1450	1453	After 1300	Flood	0.76	0.00	•	•	No	•	50	>50%	All	Standby	Yes	•	•	220	40	5	4	3	2	200	14	Cove	1.52	2.13	Pa mill	Unknown/stat	Unknown/stat
101	BF	No	1425	1436	After 1300	Flood	0.85	0.00	•	•	Yes	•	100	>50%	Standby	Standby	Yes	•	•	220	20	5	2	11	3	•	14	Cove	1.22	1.83	Pa mill	Unknown/stat	Unknown/stat
101	BF	No	1516	1517	After 1300	Flood	1.13	0.00	•	•	No	•	50	>50%	Standby	Standby	Yes	•	•	220	40	5	4	1	3	•	13	Cove	0.31	0.91	Act mill	East	East
101	BF	No	1508	1512	After 1300	Flood	1.13	0.00	•	•	No	•	50	>50%	All	Standby	Yes	•	•	220	40	5	4	4	3	•	14	Cove	0.31	0.31	Polar	East	East
101	BF	No	1519	1522	After 1300	Flood	2.44	0.00	•	•	No	•	50	>50%	Standby	Standby	Yes	•	•	220	40	5	4	3	3	•	9	Cove	0.91	1.83	Act mill	East	East
102	BF	Yes	1243	1246	Before 1300	Ebb	•	0.00	3	West	No	•	100	>50%	None	None	No	•	•	220	40	5	4	3	3	2000	5	Cons	0.31	1.22	Pa mill	Unknown/stat	Unknown/stat
102	BF	Yes	1149	1152	Before 1300	Ebb	•	0.00	3	West	No	•	100	>50%	None	None	No	•	•	220	40	5	4	3	2	•	12	Cove	0.31	1.22	Act mill	East	East
102	BF	Yes	1153	1203	Before 1300	Ebb	•	0.00	3	West	No	•	100	>50%	None	None	No	•	•	220	40	5	4	10	2	200	14	Cove	0.31	0.61	Act mill	North	West
102	BF	Yes	1232	1233	Before 1300	Ebb	•	0.00	3	West	No	•	100	>50%	None	None	No	•	•	220	40	5	4	1	3	1000	2	Cons	•	3.66	Pa mill	Unknown/stat	Unknown/stat
102	BF	Yes	1142	1143	Before 1300	Ebb	•	0.00	3	West	No	•	100	>50%	None	None	No	•	•	220	40	5	4	1	3	10000	9	Cove	1.52	3.05	Pa mill	Unknown/stat	Unknown/stat
102	BF	Yes	1258	1302	Before 1300	Ebb	•	0.00	3	West	No	•	100	>50%	None	None	No	•	•	220	40	5	4	4	3	•	9	Cove	•	1.52	Act mill	East	East
102	BF	No	954	955	Before 1300	Ebb	•	0.00	•	•	No	•	90	>50%	None	None	No	•	•	220	40	5	4	1	3	•	9	Cove	1.52	2.13	Pa mill	Unknown/stat	Unknown/stat
106	BF	Yes	1516	1518	After 1300	Ebb	0.24	•	•	•	No	•	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	2	3	•	9	Cove	3.05	4.57	Pa mill	Unknown/stat	Unknown/stat
106	BF	Yes	1500	1502	After 1300	Ebb	0.30	•	•	•	No	•	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	2	2	•	14	Cove	2.44	4.57	Pa mill	Unknown/stat	Unknown/stat
108	BF	No	1028	1029	Before 1300	Ebb	2.32	•	•	•	No	•	•	•	All	Standby	Yes	•	•	240	60	5	1	1	1	•	9	Cove	•	2.44	•	Unknown/stat	Unknown/stat
108	BF	No	1024	1025	Before 1300	Ebb	2.35	•	•	•	No	•	•	•	All	Standby	Yes	•	•	240	60	5	1	1	2	100	12	Cove	•	2.13	•	Unknown/stat	Unknown/stat
109	BF	No	948	949	Before 1300	Flood	•	•	•	East	No	•	100	>50%	None	None	No	•	•	240	60	6	4	1	3	•	9	Cove	1.83	2.44	Pa mill	Unknown/stat	Unknown/stat
109	KK	Yes	1035	1037	Before 1300	Flood	•	•	8	East	No	•	100	>50%	None	None	No	•	•	240	60	6	4	2	2	100	8	Cove	0.61	1.52	Polar	East	East
109	KK	Yes	1015	1016	Before 1300	Flood	•	•	8	East	Yes	•	100	>50%	None	None	No	•	•	240	60	6	4	1	2	250	12	Cove	0.61	0.91	Act mill	East	East
109	KK	Yes	845	850	Before 1300	Flood	•	•	8	East	Yes	•	100	>50%	None	None	No	•	•	240	60	6	4	5	2	250	9	Cove	1.52	1.52	Pa mill	West	West
109	KK	Yes	1102	1103	Before 1300	Flood	•	•	8	East	No	•	100	>50%	None	None	No	•	•	240	60	6	4	1	1	10	4	Cons	0.31	0.91	Pa mill	Unknown/stat	Unknown/stat
109	KK	Yes	1100	1101	Before 1300	Flood	•	•	8	East	No	•	100	>50%	None	None	No	•	•	240	60	6	4	1	2	200	4	Cons	0.31	0.91	Polar	East	East

J.D.	ID	Round	Start	Stop	AM/PM	T. Stg	Tide	Wave	Wd	—>	Rain	Air	Clds	Clds 2	DB State	60 State	Drive	DB Pile	60 Pile	DB Sh	60 Sh	DB -Z	60-Z	Obs'	#'s	Actual	Zone	Area	Depth	Shore	Behav	Behav Dir	Behav Dir 2
109	KK	Yes	1110	1111	Before 1300	Flood	•	•	8	East	No	•	100	>50%	None	None	No	•	•	240	60	6	4	1	1	3	1	Cons	0.31	0.91	Polar	West	West
109	KK	Yes	1040	1041	Before 1300	Flood	•	•	8	East	No	•	100	>50%	None	None	No	•	•	240	60	6	4	1	1	50	6	Cons	0.91	0.91	Polar	East	East
109	KK	Yes	1030	1031	Before 1300	Flood	•	•	8	East	Yes	•	100	>50%	None	None	No	•	•	240	60	6	4	1	2	250	9	Cove	0.31	0.91	Pa mill	West	West
110	KK	Yes	1255	1256	Before 1300	Flood	2.29	•	0	•	No	•	100	>50%	Standby	Standby	Yes	•	•	260	60	6	5	1	2	200	9	Cove	0.31	0.31	Act mill	West	West
110	KK	No	1330	1345	After 1300	Ebb	2.32	•	0	•	No	•	100	>50%	Standby	All	Yes	150	40	260	60	6	5	15	2	400	5	Cons	0.91	1.83	Pa mill	Unknown/stat	Unknown/stat
110	KK	Yes	1250	1251	Before 1300	Flood	2.32	•	0	•	No	•	100	>50%	Standby	Standby	Yes	•	•	260	60	6	5	1	2	100	9	Cove	0.31	0.61	Act mill	West	West
110	KK	Yes	1315	1316	After 1300	Flood	2.35	•	0	•	No	•	100	>50%	Standby	Standby	Yes	•	•	260	60	6	5	1	2	300	4	Cons	0.91	3.05	Polar	North	West
110	KK	Yes	1305	1310	After 1300	Flood	2.35	•	0	•	No	•	100	>50%	All	Standby	Yes	150	100	260	60	6	5	5	2	500	5	Cons	0.91	3.05	Act mill	West	West
110	KK	Yes	1220	1230	Before 1300	Flood	2.38	•	0	•	No	•	100	>50%	Standby	Standby	Yes	•	•	260	60	6	5	10	1	75	14	Cove	0.31	0.91	Polar	North	West
113	BF	No	1425	1510	After 1300	Flood	2.44	0.03	8	SE	No	•	100	>50%	All	Standby	Yes	•	•	280	60	5	3	45	3	10000	5	Cons	•	7.62	Pa mill	Unknown/stat	Unknown/stat
114	BF	Yes	1044	1045	Before 1300	Ebb	•	0.00	0	•	Yes	13	100	>50%	None	None	No	•	•	•	•	•	•	1	2	•	1	Cons	•	3.50	Polar	East	East
114	BF	Yes	955	958	Before 1300	Ebb	•	0.00	0	•	Yes	13	100	>50%	None	None	No	•	•	•	•	•	•	3	3	•	9	Cove	•	2.29	Pa mill	Unknown/stat	Unknown/stat
114	BF	Yes	1022	1027	Before 1300	Ebb	•	0.00	0	•	Yes	13	100	>50%	None	None	No	•	•	•	•	•	•	5	3	•	6	Cons	•	2.29	Pa mill	East	East
114	BF	Yes	1033	1034	Before 1300	Ebb	•	0.00	0	•	Yes	13	100	>50%	None	None	No	•	•	•	•	•	•	1	2	•	6	Cons	•	2.29	Act mill	East	East
114	BF	Yes	1035	1036	Before 1300	Ebb	•	0.00	0	•	Yes	13	100	>50%	None	None	No	•	•	•	•	•	•	1	3	•	5	Cons	1.83	2.29	Pa mill	Unknown/stat	Unknown/stat
114	BF	Yes	1029	1032	Before 1300	Ebb	•	0.00	0	•	Yes	13	100	>50%	None	None	No	•	•	•	•	•	•	3	3	•	6	Cons	•	2.29	Act mill	West	West
114	BF	Yes	1040	1042	Before 1300	Ebb	•	0.00	0	•	Yes	13	100	>50%	None	None	No	•	•	•	•	•	•	2	3	•	3	Cons	•	2.29	Act mill	Unknown/stat	Unknown/stat
114	KK	No	1640	1645	After 1300	Flood	•	•	8	West	No	•	50	>50%	None	None	No	•	•	280	60	5	2	5	3	•	5	Cons	1.52	4.57	Act mill	East	East
114	KK	No	1628	1634	After 1300	Flood	•	•	8	West	No	•	50	>50%	None	None	No	•	•	280	60	5	2	6	3	•	6	Cons	1.52	3.05	Act mill	East	East
115	BF	Yes	1237	1238	Before 1300	Flood	-0.34	0.15	3	West	No	•	60	>50%	Standby	Standby	Yes	•	•	300	60	5	2	1	2	•	6	Cons	3.05	3.35	Pa mill	Unknown/stat	Unknown/stat
115	BF	Yes	1215	1229	Before 1300	Flood	-0.34	0.15	3	West	No	•	100	>50%	Standby	Standby	Yes	•	•	300	60	5	2	14	3	•	9	Cove	3.05	3.05	Pa mill	Unknown/stat	Unknown/stat
115	BF	Yes	1238	1239	Before 1300	Flood	-0.24	0.15	3	West	No	•	60	>50%	Standby	Standby	Yes	100	•	300	60	5	2	1	2	•	5	Cons	1.52	1.83	Pa mill	Unknown/stat	Unknown/stat
115	BF	Yes	1249	1250	Before 1300	Flood	-0.34	0.15	8	West	No	•	•	•	All	Standby	Yes	•	•	300	60	5	2	1	1	•	5	Cons	0.91	1.52	Pa mill	Unknown/stat	Unknown/stat
115	BF	Yes	1245	1246	Before 1300	Flood	-0.15	0.15	8	West	No	•	60	>50%	All	Standby	Yes	150	•	300	60	5	2	1	2	100	5	Cons	3.05	3.05	Pa mill	Unknown/stat	Unknown/stat
115	BF	Yes	1238	1240	Before 1300	Flood	0.30	0.15	8	West	No	•	•	•	Standby	Standby	Yes	•	•	300	60	5	2	2	3	•	9	Cove	•	•	Pa mill	Unknown/stat	Unknown/stat
115	KK	No	1134	1200	Before 1300	Ebb	-0.30	0.00	8	West	No	13	100	>50%	Standby	Standby	Yes	•	•	300	60	5	2	26	3	•	9	Cove	1.52	1.52	Pa mill	Unknown/stat	Unknown/stat
115	LC	No	1405	1507	After 1300	Flood	0.76	0.03	8	•	No	13	75	>50%	All	All	Yes	300	•	300	60	5	4	62	2	•	6	Cons	1.22	3.05	Act mill	East	East
115	LC	No	1535	1600	After 1300	Flood	2.59	0.03	8	•	No	13	90	>50%	Standby	Standby	Yes	•	100	300	60	5	2	25	2	•	8	Cove	1.52	1.83	Pa mill	Unknown/stat	Unknown/stat
116	BF	Yes	1429	1431	After 1300	Flood	•	0.00	0	•	No	10	100	>50%	None	Standby	No	•	•	•	•	•	•	2	3	•	4	Cons	•	2.80	Pa mill	West	West
116	BF	Yes	1348	1349	After 1300	Flood	•	0.00	0	•	No	10	100	>50%	None	Standby	No	•	•	•	•	•	•	1	2	•	14	Cove	•	3.05	Polar	East	East
116	BF	Yes	1417	1422	After 1300	Flood	•	0.00	0	•	No	10	100	>50%	None	Standby	No	•	•	•	•	•	•	5	3	•	6	Cons	•	3.05	Pa mill	Unknown/stat	Unknown/stat
116	BF	Yes	1353	1357	After 1300	Flood	•	0.00	0	•	No	10	100	>50%	None	Standby	No	•	•	•	•	•	•	4	3	•	12	Cove	•	7.62	Pa mill	Unknown/stat	Unknown/stat
116	BF	Yes	1404	1409	After 1300	Flood	•	0.00	0	•	No	10	100	>50%	None	Standby	No	•	•	•	•	•	•	5	3	•	9	Cove	•	7.62	Pa mill	Unknown/stat	Unknown/stat
116	BF	Yes	1433	1434	After 1300	Flood	•	0.00	0	•	No	10	100	>50%	None	Standby	No	•	•	•	•	•	•	1	2	•	3	Cons	•	1.52	Polar	East	East
116	BF	No	1527	1528	After 1300	Flood	•	0.00	8	West	Yes	•	100	>50%	None	None	No	•	•	280	60	6	5	1	3	•	9	Cove	3.05	3.05	Pa mill	Unknown/stat	Unknown/stat
116	BF	No	1517	1525	After 1300	Flood	•	0.00	8	West	No	•	100	>50%	None	None	No	•	•	280	60	6	5	8	3	•	6	Cons	1.83	3.05	Pa mill	Unknown/stat	Unknown/stat
116	LS	Yes	1345	1346	After 1300	Flood	•	•	8	West	No	•	100	>50%	None	Standby	No	•	•	280	60	6	5	1	1	2	2	Cons	0.31	0.61	Act mill	West	West
116	LS	Yes	1428	1450	After 1300	Flood	•	•	8	West	No	•	100	>50%	None	Standby	No	•	•	280	60	6	5	22	3	•	6	Cons	1.52	3.05	Pa mill	Unknown/stat	Unknown/stat
116	LS	Yes	1535	1540	After 1300	Flood	•	•	8	West	No	•	100	>50%	None	Standby	No	•	•	280	60	6	5	5	3	•	9	Cove	1.83	0.91	Act mill	West	West
116	LS	Yes	1409	1410	After 1300	Flood	•	•	8	West	Yes	•	100	>50%	None	Standby	No	•	•	280	60	6	5	1	2	•	8	Cove	•	•	Polar	West	West
116	LS	Yes	1319	1322	After 1300	Flood	•	•	8	West	No	•	100	>50%	None	Standby	No	•	•	280	60	6	5	3	2	•	6	Cons	3.05	3.05	Act mill	Unknown/stat	Unknown/stat
116	LS	Yes	1402	1406	After 1300	Flood	•	•	8	West	No	•	100	>50%	None	Standby	No	•	•	280	60	6	5	4	3	•	5	Cons	1.22	1.83	Act mill	Unknown/stat	Unknown/stat
116	LS	Yes	1203	1209	Before 1300	Ebb	•	•	8	West	No	•	100	>50%	None	Standby	No	•	•	300	80	6	5	6	2	•	4	Cons	0.61	1.52	Act mill	West	West
116	LS	Yes	1434	1440	After 1300	Flood	•	•	8	West	Yes	•	100	>50%	None	Standby	No	•	•	280	60	6	5	6	3	•	9	Cove	1.52	1.83	Act mill	Unknown/stat	Unknown/stat
116	LS	Yes	1503	1504	After 1300	Flood	•	•	8	West	No	•	100	>50%	None	Standby	No	•	•	280	60	6	5	1	2	•	8	Cove	•	•	Act mill	Unknown/stat	Unknown/stat
116	LS	Yes	1610	1613	After 1300	Flood	•	•	8	West	No	•	100	>50%	None	Standby	No	•	•	280	60	6	5	3	3	•	6	Cons	3.96	•	Pa mill	Unknown/stat	Unknown/stat
116	LS	Yes	1615	1616	After 1300	Flood	•	•	8	West	No	•	100	>50%	None	Standby	No	•	•	280	60	6	5	1	3	•	5	Cons	4.57	3.05	Pa mill	Unknown/stat	Unknown/stat
116	LS	Yes	1340	1343	After 1300	Flood	•	•	8	West	No	•	100	>50%	None	Standby	No	•	•	280	60	6	5	3	1	•	2	Cons	0.31	0.61	Polar	West	West
116	LS	Yes	1219	1230	Before 1300	Ebb	•	•	8	West	No	•	100	>50%	None	Standby	No	•	•	280	60	6	5	11	3	•	9	Cove	4.57	3.05	Act mill	Unknown/stat	Unknown/stat
116	LS	Yes	1505	1509	After 1300	Flood	•	•	8	West	No	•	100	>50%	None	Standby	No	•	•	280	60	6	5	4	2	•	12	Cove	1.52	•	Act mill	West	West
116	LS	Yes	1328	1330	After 1300	Flood	•	•	8	West	No	•	100	>50%	None	Standby	No	•	•	280	60	6	5	2	1	•	3	Cons	0.61	0.61	Act mill	West	West
116	LS	Yes	1448	1449	After 1300	Flood	•	•	8	West	No	•	100	>50%	None	Standby	No	•	•	280	60	6	5	1	2	•	9	Cove	0.91	•	Act mill	East	East

J.D.	ID	Round	Start	Stop	AM/PM	T. Stg	Tide	Wave	Wd	—>	Rain	Air	Clds	Clds 2	DB State	60 State	Drive	DB Pile	60 Pile	DB Sh	60 Sh	DB -Z	60-Z	Obs'	#'s	Actual	Zone	Area	Depth	Shore	Behav	Behav Dir	Behav Dir 2
116	LS	Yes	1352	1353	After 1300	Flood	•	•	8	West	No	•	100	>50%	None	Standby	No	•	•	280	60	6	5	1	1	•	4	Cons	0.91	1.22	Act mill	Unknown/stat	Unknown/stat
116	LS	Yes	1250	1252	Before 1300	Flood	•	•	8	West	No	•	100	>50%	None	Standby	No	•	•	280	60	6	5	2	2	•	10	Cove	1.22	0.91	Act mill	Unknown/stat	Unknown/stat
116	LS	Yes	1256	1300	Before 1300	Flood	•	•	8	West	No	•	100	>50%	None	Standby	No	•	•	280	60	6	5	4	3	•	9	Cove	4.57	2.74	Act mill	Unknown/stat	Unknown/stat
117	BF	Yes	1045	1050	Before 1300	Ebb	0.61	0.03	3	NE	No	6	100	>50%	Standby	Standby	Yes	•	•	300	80	6	5	5	3	10000	9	Cove	1.52	1.52	Pa mill	Unknown/stat	Unknown/stat
117	BF	Yes	1039	1040	Before 1300	Ebb	0.76	0.03	3	NE	No	6	100	>50%	Standby	Standby	Yes	•	•	300	80	6	5	1	1	•	11	Cove	•	3.05	Pa mill	Unknown/stat	Unknown/stat
117	BF	Yes	1036	1037	Before 1300	Ebb	0.76	0.03	3	NE	No	6	100	>50%	Standby	Standby	Yes	•	•	300	80	6	5	1	1	•	12	Cove	0.61	3.05	Pa mill	Unknown/stat	Unknown/stat
117	BF	Yes	1035	1036	Before 1300	Ebb	0.76	0.03	3	NE	No	6	100	>50%	Standby	Standby	Yes	•	•	300	80	6	5	1	2	100	14	Cove	0.61	3.05	Pa mill	Unknown/stat	Unknown/stat
117	BF	Yes	1040	1041	Before 1300	Ebb	0.76	0.03	3	NE	No	6	100	>50%	Standby	Standby	Yes	•	•	300	80	6	5	1	2	•	11	Cove	•	•	Act mill	West	West
117	BF	Yes	1042	1043	Before 1300	Ebb	0.76	0.03	3	NE	No	6	100	>50%	Standby	Standby	Yes	•	•	300	80	6	5	1	2	•	11	Cove	•	•	Act mill	North	West
117	BF	Yes	1146	1147	Before 1300	Ebb	-0.30	0.00	8	East	Yes	•	100	>50%	Standby	Standby	Yes	•	120	300	80	6	4	1	3	•	3	Cons	0.31	0.31	Pa mill	Unknown/stat	Unknown/stat
117	BF	Yes	1144	1145	Before 1300	Ebb	-0.30	0.00	8	East	No	•	100	>50%	Standby	Standby	Yes	•	100	300	80	6	4	1	3	•	3	Cons	0.31	0.31	Pa mill	Unknown/stat	Unknown/stat
117	BF	Yes	1147	1148	Before 1300	Ebb	-0.30	0.00	8	East	No	•	100	>50%	Standby	Standby	Yes	•	150	300	80	6	4	1	3	1000	3	Cons	0.31	0.31	Pa mill	Unknown/stat	Unknown/stat
117	BF	Yes	1142	1143	Before 1300	Ebb	-0.30	0.00	8	East	No	•	100	>50%	Standby	Standby	Yes	•	90	300	80	6	4	1	3	•	3	Cons	•	1.52	Pa mill	Unknown/stat	Unknown/stat
117	BF	Yes	1136	1139	Before 1300	Ebb	-0.15	0.00	8	East	No	•	100	>50%	Standby	All	Yes	•	50	300	80	6	4	3	3	•	4	Cons	0.31	0.61	Polar	East	East
117	BF	Yes	1120	1123	Before 1300	Ebb	-0.15	0.00	8	East	No	•	100	>50%	Standby	Standby	Yes	•	•	300	80	6	4	3	3	•	5	Cons	0.91	1.22	Act mill	East	East
117	BF	Yes	1125	1128	Before 1300	Ebb	-0.15	0.00	8	East	No	•	100	>50%	Standby	Standby	Yes	•	40	300	80	6	4	3	3	•	5	Cons	0.91	1.52	Pa mill	Unknown/stat	Unknown/stat
117	BF	Yes	1140	1141	Before 1300	Ebb	-0.15	0.00	8	East	No	•	100	>50%	Standby	Standby	Yes	•	70	300	80	6	4	1	3	•	4	Cons	0.31	•	Pa mill	Unknown/stat	Unknown/stat
117	BF	Yes	1118	1119	Before 1300	Ebb	0.06	0.00	8	East	No	•	100	>50%	Standby	Standby	Yes	•	•	300	80	6	4	1	1	•	6	Cons	0.31	0.31	Polar	East	East
117	BF	Yes	1110	1116	Before 1300	Ebb	0.21	0.00	8	East	No	•	100	>50%	All	All	Yes	100	•	300	80	6	4	6	3	•	6	Cons	0.91	1.52	Pa mill	Unknown/stat	Unknown/stat
117	BF	Yes	1102	1109	Before 1300	Ebb	0.21	0.00	8	East	No	•	100	>50%	All	All	Yes	•	•	300	80	6	4	7	3	•	6	Cons	0.91	2.44	Pa mill	Unknown/stat	Unknown/stat
117	BF	Yes	1058	1059	Before 1300	Ebb	0.30	0.00	8	East	No	•	100	>50%	All	Standby	Yes	•	•	300	80	6	5	1	2	•	8	Cove	•	•	Polar	West	West
117	BF	Yes	1051	1054	Before 1300	Ebb	0.76	0.00	8	East	No	•	100	>50%	All	Standby	Yes	•	•	300	80	6	5	3	3	•	9	Cove	•	•	Pa mill	Unknown/stat	Unknown/stat
117	KK	No	958	959	Before 1300	Ebb	1.43	•	8	East	Yes	•	100	>50%	Standby	All	Yes	200	120	300	60	6	5	1	3	•	6	Cons	0.61	1.52	Polar	West	West
117	KK	No	952	958	Before 1300	Ebb	1.43	•	8	East	Yes	•	100	>50%	Standby	All	Yes	200	120	300	60	6	5	6	3	•	6	Cons	0.31	1.52	Act mill	West	West
117	LC	Yes	1415	1425	After 1300	Flood	-0.61	0.06	40	•	No	•	100	>50%	Standby	All	Yes	200	100	300	80	6	4	10	3	•	5	Cons	0.91	0.61	Act mill	East	East
117	LC	Yes	1425	1426	After 1300	Flood	-0.30	0.06	40	•	No	•	100	>50%	All	All	Yes	200	100	300	80	6	4	1	1	•	5	Cons	1.22	1.22	Pa mill	Unknown/stat	Unknown/stat
117	LC	Yes	1427	1445	After 1300	Flood	-0.30	0.06	40	•	No	•	100	>50%	Standby	Standby	Yes	200	70	300	60	6	4	18	1	•	5	Cons	0.91	0.61	Act mill	Unknown/stat	Unknown/stat
117	LC	Yes	1520	1525	After 1300	Flood	0.15	0.06	40	•	No	•	100	>50%	Standby	All	Yes	200	70	300	80	6	4	5	1	•	4	Cons	0.91	0.91	Pa mill	Unknown/stat	Unknown/stat
117	LC	Yes	1600	1601	After 1300	Flood	0.85	0.06	40	•	No	•	100	>50%	Standby	Standby	Yes	200	100	300	60	6	4	1	3	•	5	Cons	0.91	1.52	Act mill	East	East
120	BF	Yes	1034	1035	Before 1300	Ebb	•	0.00	0	•	No	13	0	<50%	Standby	Standby	Yes	•	•	220	60	6	3	1	2	•	9	Cove	0.91	1.83	Polar	West	West
120	BF	Yes	1009	1012	Before 1300	Ebb	•	0.00	0	•	No	13	0	<50%	Standby	Standby	Yes	•	•	220	60	6	3	3	3	•	14	Cove	1.22	3.05	Pa mill	Unknown/stat	Unknown/stat
120	BF	Yes	1036	1038	Before 1300	Ebb	•	0.00	0	•	No	13	0	<50%	Standby	Standby	Yes	•	•	220	60	6	3	2	2	•	9	Cove	0.61	1.83	Polar	West	West
120	BF	Yes	1016	1019	Before 1300	Ebb	•	0.00	0	•	No	13	7	<50%	Standby	Standby	Yes	•	•	220	60	6	3	3	2	•	14	Cove	0.91	0.91	Polar	North	West
120	BF	Yes	1033	1034	Before 1300	Ebb	•	0.00	0	•	No	13	0	<50%	Standby	Standby	Yes	•	•	220	60	6	3	1	1	•	9	Cove	0.91	1.83	Polar	West	West
120	BF	Yes	1013	1014	Before 1300	Ebb	•	0.00	0	•	No	13	0	<50%	Standby	Standby	Yes	•	•	220	60	6	3	1	2	•	14	Cove	0.61	0.31	Polar	North	West
120	BF	Yes	1022	1023	Before 1300	Ebb	2.59	0.00	2	West	No	13	0	<50%	Standby	Standby	Yes	•	•	220	60	6	3	1	2	•	12	Cove	0.91	3.05	Polar	West	West
120	BF	Yes	1026	1027	Before 1300	Ebb	•	0.00	2	West	No	13	0	<50%	Standby	Standby	Yes	•	•	220	60	6	3	1	1	•	12	Cove	0.31	2.44	Polar	West	West
120	BF	Yes	1020	1021	Before 1300	Ebb	•	0.00	2	West	No	13	0	<50%	Standby	Standby	Yes	•	•	220	60	6	3	1	1	•	14	Cove	0.91	1.83	Polar	South	East
120	BF	Yes	1041	1042	Before 1300	Ebb	2.35	0.03	2	West	No	13	0	<50%	Standby	Standby	Yes	•	•	220	60	6	3	1	3	•	8	Cove	1.22	2.44	Act mill	North	West
120	BF	Yes	1039	1040	Before 1300	Ebb	•	0.03	2	West	No	13	0	<50%	Standby	Standby	Yes	•	•	220	60	6	3	1	2	•	8	Cove	0.31	1.83	Polar	North	West
120	BF	Yes	1043	1045	Before 1300	Ebb	•	0.03	2	West	No	13	0	<50%	Standby	Standby	Yes	150	300	220	60	6	3	2	3	•	7	Cons	0.91	3.05	Pa mill	Unknown/stat	Unknown/stat
120	BF	No	1259	1300	Before 1300	Ebb	-0.30	0.00	0	•	No	16	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	•	14	Cove	1.22	•	Polar	North	West
120	BF	No	1300	1310	Before 1300	Ebb	0.40	0.00	0	•	No	16	0	<50%	All	Standby	Yes	•	•	•	•	•	•	10	2	•	14	Cove	0.61	•	Act mill	East	East
120	BF	No	1320	1321	After 1300	Ebb	0.70	0.00	0	•	No	16	0	<50%	All	All	Yes	•	•	•	•	•	•	1	1	•	11	Cove	0.91	2.44	Polar	West	West
120	BF	No	1317	1319	After 1300	Ebb	0.73	0.00	0	•	No	16	0	<50%	All	Standby	Yes	•	•	•	•	•	•	2	2	•	11	Cove	0.91	3.05	Pa mill	Unknown/stat	Unknown/stat
120	BF	No	1315	1317	After 1300	Ebb	0.73	0.00	0	•	No	16	0	<50%	All	Standby	Yes	•	•	•	•	•	•	2	2	•	12	Cove	0.61	2.44	Pa mill	Unknown/stat	Unknown/stat
120	BF	No	1319	1320	After 1300	Ebb	•	0.00	0	•	No	16	0	<50%	All	All	Yes	•	•	•	•	•	•	1	1	•	11	Cove	0.31	2.44	Polar	West	West
120	BF	No	1312	1314	After 1300	Ebb	•	0.00	0	•	No	16	0	<50%	All	Standby	Yes	•	•	•	•	•	•	2	2	•	12	Cove	0.61	3.05	Act mill	East	East
120	BF	No	1323	1324	After 1300	Ebb	•	0.00	0	•	No	16	0	<50%	All	All	Yes	•	•	•	•	•	•	1	1	•	9	Cove	0.91	2.44	Polar	East	East
120	BF	No	1253	1255	Before 1300	Ebb	•	0.00	0	•	No	16	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	2	2	•	14	Cove	1.52	1.52	Pa mill	Unknown/stat	Unknown/stat
120	BF	No	1326	1328	After 1300	Ebb	•	0.00	0	•	No	16	0	<50%	All	Standby	Yes	•	•	240	60	6	3	2	2	•	9	Cove	0.91	0.31	Pa mill	Unknown/stat	Unknown/stat
120	BF	No	1256	1258	Before 1300	Ebb	•	0.00	0	•	No	16	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	2	1	•	14	Cove	0.61	3.05	Act mill	North	West

J.D.	ID	Round	Start	Stop	AM/PM	T. Stg	Tide	Wave	Wd	—>	Rain	Air	Clds	Clds 2	DB State	60 State	Drive	DB Pile	60 Pile	DB Sh	60 Sh	DB -Z	60-Z	Obs'	#'s	Actual	Zone	Area	Depth	Shore	Behav	Behav Dir	Behav Dir 2
120	BF	Yes	1223	1226	Before 1300	Ebb	1.22	0.00	0	•	No	•	0	<50%	All	Standby	Yes	•	•	220	60	6	3	3	3	•	6	Cons	•	7.62	Act mill	East	East
120	BF	Yes	1207	1211	Before 1300	Ebb	1.43	0.00	0	•	No	•	0	<50%	Standby	Standby	Yes	•	•	220	80	6	3	4	3	•	5	Cons	0.61	2.44	Pa mill	Unknown/stat	Unknown/stat
120	BF	Yes	1219	1222	Before 1300	Ebb	1.43	0.00	0	•	No	•	0	<50%	Standby	All	Yes	•	•	220	60	6	3	3	3	•	6	Cons	•	7.62	Pa mill	Unknown/stat	Unknown/stat
120	BF	Yes	1216	1218	Before 1300	Ebb	1.43	0.00	0	•	No	•	0	<50%	Standby	All	Yes	•	•	220	60	6	3	2	1	•	6	Cons	0.31	4.57	Polar	West	West
120	BF	Yes	1159	1201	Before 1300	Ebb	1.68	0.00	0	•	No	•	0	<50%	Standby	Standby	Yes	•	•	220	80	6	3	2	2	•	3	Cons	0.61	0.91	Act mill	West	West
120	BF	Yes	1136	1139	Before 1300	Ebb	1.80	0.00	0	•	No	•	0	<50%	All	All	Yes	150	•	220	60	6	3	3	2	•	6	Cons	0.61	0.91	Pa mill	Unknown/stat	Unknown/stat
120	BF	Yes	1204	1205	Before 1300	Ebb	1.80	0.00	0	•	No	•	0	<50%	Standby	Standby	Yes	•	•	220	60	6	3	1	1	50	5	Cons	0.61	1.22	Act mill	East	East
120	BF	Yes	1118	1119	Before 1300	Ebb	1.95	0.00	0	•	No	•	0	<50%	Standby	Standby	Yes	•	•	220	60	6	3	1	3	•	4	Cons	0.61	0.91	Polar	East	East
120	BF	Yes	1052	1118	Before 1300	Ebb	1.95	0.00	0	•	No	•	0	<50%	Standby	All	Yes	•	50	220	60	6	3	26	3	•	4	Cons	0.61	0.91	Act mill	West	West
120	BF	Yes	1124	1125	Before 1300	Ebb	1.95	0.00	0	•	No	•	0	<50%	Standby	Standby	Yes	•	•	220	60	6	3	1	2	•	1	Cons	0.61	0.61	Act mill	West	West
120	BF	Yes	1132	1133	Before 1300	Ebb	1.95	0.00	0	•	No	•	0	<50%	All	Standby	Yes	•	•	220	60	6	3	1	2	•	7	Cons	0.91	1.22	Act mill	West	West
120	BF	Yes	1133	1134	Before 1300	Ebb	2.10	0.00	0	•	No	•	0	<50%	All	Standby	Yes	150	•	220	60	6	3	1	3	•	6	Cons	0.91	1.22	Pa mill	Unknown/stat	Unknown/stat
120	BF	Yes	1134	1135	Before 1300	Ebb	•	0.00	0	•	No	•	0	<50%	All	Standby	Yes	150	•	220	60	6	3	1	3	•	6	Cons	1.83	3.05	Pa mill	Unknown/stat	Unknown/stat
120	KK	Yes	845	846	Before 1300	Ebb	•	0.15	11	East	No	•	0	<50%	Standby	Standby	Yes	250	80	220	60	6	3	1	1	•	4	Cons	0.91	1.52	Act mill	East	East
120	KK	No	854	855	Before 1300	Ebb	2.74	0.15	11	East	No	•	0	<50%	Standby	Standby	Yes	150	100	220	60	6	3	1	2	•	5	Cons	0.91	1.52	Act mill	East	East
120	KK	No	851	858	Before 1300	Ebb	2.74	0.15	11	East	No	•	0	<50%	Standby	Standby	Yes	150	120	220	60	6	3	7	1	•	5	Cons	0.91	1.52	Act mill	West	West
120	KK	Yes	815	822	Before 1300	Ebb	•	0.15	11	East	No	•	0	<50%	Standby	Standby	Yes	200	80	220	60	6	3	7	3	•	6	Cons	0.91	1.52	Act mill	West	West
120	KK	Yes	800	805	Before 1300	Flood	•	0.15	11	East	No	•	0	<50%	Standby	Standby	Yes	•	•	220	60	6	3	5	3	•	9	Cove	0.91	0.91	Pa mill	Unknown/stat	Unknown/stat
120	KK	Yes	810	815	Before 1300	Flood	•	0.15	11	East	No	•	0	<50%	Standby	Standby	Yes	150	100	220	60	6	3	5	3	•	7	Cons	0.91	1.52	Act mill	East	East
120	LC	Yes	1520	1521	After 1300	Ebb	-0.30	0.00	0	•	No	16	0	<50%	Standby	Standby	Yes	100	280	240	80	6	3	1	3	•	6	Cons	1.52	2.44	Pa mill	Unknown/stat	Unknown/stat
120	LC	Yes	1515	1520	After 1300	Ebb	-0.30	0.00	0	•	No	16	0	<50%	Standby	Standby	Yes	100	300	240	80	6	3	5	1	•	6	Cons	0.31	0.61	Act mill	East	East
120	LC	Yes	1510	1511	After 1300	Ebb	-0.30	0.00	0	•	No	16	0	<50%	Standby	Standby	Yes	•	•	240	80	6	3	1	1	•	8	Cove	3.05	3.05	Act mill	West	West
120	LC	Yes	1500	1505	After 1300	Ebb	-0.27	0.00	0	•	No	16	0	<50%	Standby	Standby	Yes	•	•	240	80	6	3	5	1	•	9	Cove	3.05	1.22	Act mill	West	West
120	LC	Yes	1505	1510	After 1300	Ebb	-0.27	0.00	0	•	No	16	0	<50%	Standby	Standby	Yes	•	•	240	80	6	3	5	2	•	8	Cove	1.52	2.74	Act mill	West	West
120	LC	Yes	1455	1500	After 1300	Ebb	-0.27	0.00	0	•	No	16	0	<50%	All	Standby	Yes	•	•	240	80	6	3	5	2	•	9	Cove	3.05	2.44	Act mill	West	West
120	LC	Yes	1530	1600	After 1300	Ebb	-0.12	0.00	0	•	No	16	0	<50%	Standby	Standby	Yes	•	50	240	60	6	3	30	1	•	4	Cons	0.61	0.91	Polar	East	East
120	LC	Yes	1417	1419	After 1300	Ebb	0.00	0.00	0	•	No	16	0	<50%	All	Standby	Yes	•	•	240	80	6	3	2	1	•	11	Cove	1.83	2.44	Polar	West	West
120	LC	Yes	1423	1425	After 1300	Ebb	0.00	0.00	0	•	No	16	0	<50%	Standby	Standby	Yes	•	•	240	80	6	3	2	2	•	11	Cove	1.83	2.44	Act mill	West	West
120	LC	No	1606	1607	After 1300	Flood	0.06	0.00	0	•	No	16	0	<50%	All	Standby	Yes	150	100	240	80	6	3	1	2	•	5	Cons	0.31	1.22	Pa mill	Unknown/stat	Unknown/stat
120	LC	Yes	1401	1410	After 1300	Ebb	0.06	0.00	0	•	No	16	0	<50%	Standby	All	Yes	•	•	240	80	6	3	9	2	•	12	Cove	1.22	1.52	Polar	North	West
120	LC	Yes	1411	1415	After 1300	Ebb	0.06	0.00	0	•	No	16	0	<50%	Standby	All	Yes	•	•	240	80	6	3	4	1	•	11	Cove	0.61	2.44	Act mill	North	West
120	LC	Yes	1400	1401	After 1300	Ebb	•	0.00	0	•	No	16	0	<50%	All	All	Yes	•	•	240	80	6	3	1	1	30	14	Cove	0.31	0.61	Polar	East	East
120	LC	Yes	1427	1450	After 1300	Ebb	•	0.00	0	•	No	16	0	<50%	Standby	Standby	Yes	•	•	240	80	6	3	23	2	•	11	Cove	1.83	1.52	Act mill	East	East
121	BF	No	1002	1004	Before 1300	Ebb	•	0.06	3	East	No	13	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	2	3	•	9	Cove	2.44	3.05	Pa mill	Unknown/stat	Unknown/stat
121	KK	No	827	830	Before 1300	Flood	•	0.00	8	East	Yes	10	100	>50%	All	Standby	Yes	100	•	•	•	•	•	3	3	•	5	Cons	0.91	1.52	Pa mill	Unknown/stat	Unknown/stat
121	KK	No	812	820	Before 1300	Flood	•	0.00	8	East	No	10	100	>50%	Standby	All	Yes	100	35	•	•	•	•	8	2	•	6	Cons	1.22	6.10	Pa mill	Unknown/stat	Unknown/stat
121	LS	Yes	1248	1249	Before 1300	Ebb	•	0.00	0	•	No	10	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	•	11	Cove	0.31	0.91	Polar	West	West
121	LS	Yes	1449	1450	After 1300	Ebb	•	0.00	0	•	Yes	10	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	20	5	Cons	•	•	Polar	South	East
121	LS	Yes	1434	1435	After 1300	Ebb	•	0.00	0	•	Yes	10	100	>50%	Standby	All	Yes	500	700	•	•	•	•	1	3	•	5	Cons	1.22	3.05	Pa mill	Unknown/stat	Unknown/stat
121	LS	No	1502	1503	After 1300	Ebb	•	0.00	0	•	Yes	10	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	2	150	9	Cove	0.61	0.61	Act mill	West	West
121	LS	Yes	1427	1428	After 1300	Ebb	•	0.00	0	•	Yes	10	100	>50%	Standby	Standby	Yes	400	500	•	•	•	•	1	1	20	5	Cons	•	1.22	Polar	West	West
121	LS	Yes	1249	1250	Before 1300	Ebb	•	0.00	0	•	No	10	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	•	11	Cove	•	0.91	Act mill	West	West
121	LS	No	1500	1501	After 1300	Ebb	•	0.00	0	•	Yes	10	100	>50%	All	Standby	Yes	•	•	•	•	•	•	1	2	•	9	Cove	•	1.22	Act mill	Unknown/stat	Unknown/stat
121	LS	Yes	1255	1256	Before 1300	Ebb	•	0.00	0	•	No	10	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	2	200	11	Cove	0.91	•	Act mill	East	East
121	LS	Yes	1040	1041	Before 1300	Ebb	•	0.00	3	East	No	10	100	>50%	All	Standby	Yes	•	•	•	•	•	•	1	2	200	6	Cons	3.05	0.61	Act mill	Unknown/stat	Unknown/stat
121	LS	Yes	1036	1037	Before 1300	Ebb	•	0.00	3	East	No	10	100	>50%	All	Standby	Yes	•	•	•	•	•	•	1	3	•	5	Cons	•	6.10	Act mill	East	East
121	LS	Yes	1027	1028	Before 1300	Ebb	•	0.00	3	East	No	10	100	>50%	All	Standby	Yes	•	•	•	•	•	•	1	1	50	5	Cons	•	15.24	Act mill	North	East
121	LS	Yes	1019	1021	Before 1300	Ebb	•	0.03	5	East	No	10	100	>50%	Standby	All	Yes	•	•	•	•	•	•	2	3	•	5	Cons	1.83	2.44	Act mill	East	East
121	LS	Yes	1015	1016	Before 1300	Ebb	•	0.03	5	East	No	10	100	>50%	Standby	All	Yes	•	•	•	•	•	•	1	2	400	5	Cons	6.10	5.49	Act mill	East	East
121	LS	Yes	1004	1006	Before 1300	Ebb	•	0.03	5	East	No	10	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	2	1	60	2	Cons	•	0.61	Polar	East	East
121	LS	Yes	830	832	Before 1300	Flood	•	0.00	8	East	No	10	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	2	2	200	9	Cove	1.52	2.44	Act mill	Unknown/stat	Unknown/stat
121	LS	Yes	800	805	Before 1300	Flood	•	0.00	8	East	No	10	100	>50%	Standby	All	Yes	•	•	•	•	•	•	5	3	•	14	Cove	0.61	1.22	Act mill	North	West

J.D.	ID	Round	Start	Stop	AM/PM	T. Stg	Tide	Wave	Wd	—>	Rain	Air	Clds	Clds 2	DB State	60 State	Drive	DB Pile	60 Pile	DB Sh	60 Sh	DB -Z	60-Z	Obs'	#'s	Actual	Zone	Area	Depth	Shore	Behav	Behav Dir	Behav Dir 2
121	LS	Yes	813	817	Before 1300	Flood	•	0.00	8	East	No	10	100	>50%	All	Standby	Yes	•	•	•	•	•	•	4	1	90	11	Cove	0.61	0.91	Polar	East	East
121	LS	Yes	838	840	Before 1300	Flood	•	0.00	8	East	No	10	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	2	3	•	9	Cove	1.83	0.31	Pa mill	Unknown/stat	Unknown/stat
121	LS	Yes	808	809	Before 1300	Flood	•	0.00	8	East	No	10	100	>50%	All	Standby	Yes	•	•	•	•	•	•	1	1	8	14	Cove	0.61	0.91	Polar	West	West
121	LS	Yes	847	850	Before 1300	Flood	•	0.00	8	East	No	10	100	>50%	Standby	All	Yes	•	•	•	•	•	•	3	2	100	8	Cove	0.91	0.91	Act mill	Unknown/stat	Unknown/stat
121	LS	Yes	1043	1044	Before 1300	Ebb	•	0.03	13	East	No	10	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	2	225	7	Cons	3.05	3.05	Act mill	Unknown/stat	Unknown/stat
121	LS	Yes	1050	1051	Before 1300	Ebb	•	0.03	13	East	No	10	100	>50%	Standby	All	Yes	•	•	•	•	•	•	1	2	100	9	Cove	0.61	2.44	Act mill	West	West
121	LS	Yes	1058	1100	Before 1300	Ebb	•	0.03	13	East	No	10	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	2	3	•	9	Cove	•	3.96	Act mill	Unknown/stat	Unknown/stat
121	LS	Yes	921	922	Before 1300	Flood	•	0.15	13	East	No	10	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	25	5	Cons	•	15.24	Act mill	Unknown/stat	Unknown/stat
121	LS	Yes	903	905	Before 1300	Flood	•	0.15	13	East	No	10	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	2	1	40	6	Cons	•	•	Act mill	East	East
121	LS	Yes	1048	1049	Before 1300	Ebb	•	0.15	13	East	No	10	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	50	8	Cove	3.05	0.61	Act mill	South	East
121	LS	Yes	925	934	Before 1300	Flood	•	0.15	13	East	No	10	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	9	3	•	5	Cons	•	3.05	Act mill	Unknown/stat	Unknown/stat
121	LS	Yes	947	948	Before 1300	Ebb	•	0.15	13	East	No	10	100	>50%	All	Standby	Yes	•	•	•	•	•	•	1	2	200	4	Cons	•	0.91	Polar	East	East
121	LS	Yes	916	917	Before 1300	Flood	•	0.15	13	East	No	10	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	20	6	Cons	•	15.24	Polar	East	East
121	LS	Yes	901	902	Before 1300	Flood	•	0.15	13	East	No	10	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	3	1000	7	Cons	1.22	1.22	Polar	East	East
121	LS	Yes	940	942	Before 1300	Flood	•	0.15	13	East	No	10	100	>50%	All	Standby	Yes	300	•	•	•	•	•	2	3	•	5	Cons	1.22	1.22	Act mill	East	East
121	LS	Yes	855	856	Before 1300	Flood	•	0.15	13	East	No	10	100	>50%	Standby	All	Yes	•	•	•	•	•	•	1	2	100	7	Cons	•	•	Polar	East	East
121	LS	Yes	1119	1120	Before 1300	Ebb	•	0.03	16	East	No	10	100	>50%	All	Standby	Yes	•	•	•	•	•	•	1	1	25	14	Cove	1.22	•	Act mill	West	West
121	LS	Yes	1108	1110	Before 1300	Ebb	•	0.03	16	East	No	10	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	2	1	20	10	Cove	0.91	1.52	Polar	West	West
121	LS	Yes	1212	1215	Before 1300	Ebb	•	0.00	6	SE	No	11	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	3	3	1000	14	Cove	0.91	1.83	Act mill	Unknown/stat	Unknown/stat
121	LS	Yes	1207	1208	Before 1300	Ebb	•	0.00	6	SE	No	11	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	50	14	Cove	0.61	0.61	Act mill	Unknown/stat	Unknown/stat
121	LS	Yes	1414	1415	After 1300	Ebb	•	0.15	0	•	No	14	100	>50%	All	Standby	Yes	•	•	•	•	•	•	1	1	15	5	Cons	0.61	0.91	Polar	East	East
121	LS	Yes	1409	1413	After 1300	Ebb	•	0.15	0	•	No	14	100	>50%	All	All	Yes	300	•	•	•	•	•	4	1	25	5	Cons	0.91	1.83	Act mill	Unknown/stat	Unknown/stat
121	LS	Yes	1420	1421	After 1300	Ebb	•	0.15	0	•	No	14	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	3	5	Cons	0.31	0.61	Act mill	East	East
121	LS	Yes	1259	1300	Before 1300	Ebb	•	0.30	0	•	No	14	100	>50%	Standby	All	Yes	•	•	•	•	•	•	1	1	7	10	Cove	0.61	•	Polar	West	West
121	LS	Yes	1333	1350	After 1300	Ebb	•	0.30	0	•	No	14	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	17	3	•	6	Cons	1.22	1.22	Act mill	East	East
121	LS	Yes	1310	1316	After 1300	Ebb	•	0.30	0	•	No	14	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	6	3	•	9	Cove	0.61	•	Act mill	East	East
121	LS	Yes	1321	1322	After 1300	Ebb	•	0.30	0	•	No	14	100	>50%	All	Standby	Yes	•	•	•	•	•	•	1	1	•	8	Cove	0.31	•	Act mill	South	East
121	LS	Yes	1303	1304	After 1300	Ebb	•	0.30	0	•	No	14	100	>50%	Standby	All	Yes	•	•	•	•	•	•	1	1	•	9	Cove	0.61	0.61	Polar	West	West
121	LS	Yes	1323	1328	After 1300	Ebb	•	0.30	0	•	No	14	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	5	1	•	7	Cons	2.13	2.13	Act mill	Unknown/stat	Unknown/stat
122	BF	Yes	1024	1025	Before 1300	Flood	•	0.00	0	•	No	10	100	>50%	All	Standby	Yes	•	•	•	•	•	•	1	2	•	12	Cove	0.61	1.52	Pa mill	Unknown/stat	Unknown/stat
122	BF	Yes	1029	1030	Before 1300	Flood	•	0.00	0	•	No	10	100	>50%	All	Standby	Yes	•	•	•	•	•	•	1	1	•	11	Cove	0.61	2.13	Polar	West	West
122	BF	Yes	1015	1023	Before 1300	Flood	•	0.00	0	•	No	10	100	>50%	All	Standby	Yes	•	•	•	•	•	•	8	3	•	14	Cove	1.52	•	Pa mill	Unknown/stat	Unknown/stat
122	BF	Yes	1027	1028	Before 1300	Flood	•	0.00	0	•	No	10	100	>50%	All	Standby	Yes	•	•	•	•	•	•	1	2	•	11	Cove	0.61	1.52	Pa mill	Unknown/stat	Unknown/stat
122	BF	Yes	1011	1015	Before 1300	Flood	•	0.00	0	•	Yes	10	100	>50%	All	Standby	Yes	•	•	•	•	•	•	4	3	•	14	Cove	1.83	2.44	Pa mill	Unknown/stat	Unknown/stat
122	BF	Yes	1239	1302	Before 1300	Ebb	•	0.00	0	•	No	10	100	>50%	All	All	Yes	200	45	•	•	•	•	23	2	•	5	Cons	1.22	3.35	Pa mill	Unknown/stat	Unknown/stat
122	BF	Yes	1231	1235	Before 1300	Ebb	•	0.00	0	•	No	10	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	4	2	•	5	Cons	0.91	2.44	Act mill	West	West
122	BF	Yes	1235	1236	Before 1300	Ebb	•	0.00	0	•	No	10	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	2	•	5	Cons	0.91	3.05	Pa mill	Unknown/stat	Unknown/stat
122	BF	Yes	1050	1103	Before 1300	Flood	•	0.00	0	•	No	10	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	13	3	2000	8	Cove	0.91	1.52	Pa mill	Unknown/stat	Unknown/stat
122	BF	Yes	1033	1050	Before 1300	Flood	•	0.00	0	•	No	10	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	17	3	•	11	Cove	0.91	1.52	Pa mill	Unknown/stat	Unknown/stat
122	BF	Yes	1025	1026	Before 1300	Flood	•	0.00	0	•	No	10	100	>50%	All	Standby	Yes	•	•	•	•	•	•	1	2	•	11	Cove	0.61	1.52	Pa mill	Unknown/stat	Unknown/stat
122	BF	Yes	1030	1033	Before 1300	Flood	•	0.00	0	•	No	10	100	>50%	All	Standby	Yes	•	•	•	•	•	•	3	3	•	11	Cove	0.91	2.44	Pa mill	Unknown/stat	Unknown/stat
122	BF	Yes	1128	1138	Before 1300	Ebb	•	0.06	0	•	No	10	100	>50%	Standby	Standby	Yes	200	150	•	•	•	•	10	3	•	6	Cons	1.22	2.74	Pa mill	Unknown/stat	Unknown/stat
122	BF	Yes	1202	1203	Before 1300	Ebb	•	0.06	0	•	No	10	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	•	6	Cons	3.66	9.14	Polar	East	East
122	BF	Yes	1106	1112	Before 1300	Flood	•	0.06	0	•	No	10	100	>50%	All	Standby	Yes	300	300	•	•	•	•	6	2	•	7	Cons	1.83	0.91	Act mill	East	East
122	BF	Yes	1113	1120	Before 1300	Flood	•	0.06	0	•	No	10	100	>50%	All	Standby	Yes	250	200	•	•	•	•	7	3	•	6	Cons	0.31	1.52	Pa mill	Unknown/stat	Unknown/stat
122	BF	Yes	1205	1214	Before 1300	Ebb	•	0.06	0	•	No	10	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	9	2	•	6	Cons	3.66	7.62	Pa mill	Unknown/stat	Unknown/stat
122	BF	Yes	1147	1201	Before 1300	Ebb	•	0.06	0	•	No	10	100	>50%	Standby	Standby	Yes	200	60	•	•	•	•	14	2	•	6	Cons	1.22	3.05	Pa mill	Unknown/stat	Unknown/stat
122	BF	Yes	1226	1228	Before 1300	Ebb	•	0.06	0	•	No	10	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	2	2	•	5	Cons	1.22	3.05	Pa mill	Unknown/stat	Unknown/stat
122	BF	Yes	1138	1145	Before 1300	Ebb	•	0.06	0	•	No	10	100	>50%	Standby	All	Yes	200	150	•	•	•	•	7	3	•	6	Cons	1.22	2.74	Pa mill	Unknown/stat	Unknown/stat
122	BF	Yes	1120	1127	Before 1300	Ebb	•	0.06	0	•	No	10	100	>50%	All	Standby	Yes	250	190	•	•	•	•	7	2	•	6	Cons	0.31	1.83	Pa mill	Unknown/stat	Unknown/stat
123	LS	Yes	1228	1229	Before 1300	Flood	•	0.03	8	West	No	16	0	<50%	Standby	Standby	Yes	•	80	•	•	•	•	1	2	100	5	Cons	2.74	3.05	Polar	West	West
123	LS	Yes	1211	1215	Before 1300	Flood	•	0.03	8	West	No	16	0	<50%	Standby	Standby	Yes	400	200	•	•	•	•	4	3	1000	5	Cons	1.22	1.52	Act mill	Unknown/stat	Unknown/stat

J.D.	ID	Round	Start	Stop	AM/PM	T. Stg	Tide	Wave	Wd	—>	Rain	Air	Clds	Clds 2	DB State	60 State	Drive	DB Pile	60 Pile	DB Sh	60 Sh	DB -Z	60-Z	Obs'	#'s	Actual	Zone	Area	Depth	Shore	Behav	Behav Dir	Behav Dir 2
123	LS	Yes	1220	1224	Before 1300	Flood	•	0.03	8	West	No	16	0	<50%	Standby	Standby	Yes	400	80	•	•	•	•	4	2	550	5	Cons	2.13	3.05	Act mill	West	West
123	LS	Yes	1234	1242	Before 1300	Flood	•	0.03	16	West	No	16	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	8	2	200	3	Cons	0.91	1.22	Act mill	East	East
123	LS	Yes	1150	1151	Before 1300	Flood	•	0.03	16	West	No	16	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	3	•	6	Cons	2.13	0.91	Act mill	Unknown/stat	Unknown/stat
123	LS	Yes	1125	1130	Before 1300	Flood	•	0.03	16	West	No	16	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	5	3	1750	9	Cove	•	0.91	Act mill	Unknown/stat	Unknown/stat
123	LS	Yes	1306	1307	After 1300	Ebb	•	0.03	16	West	No	16	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	3	•	5	Cons	3.96	1.52	Polar	Unknown/stat	Unknown/stat
123	LS	Yes	1343	1344	After 1300	Ebb	•	0.03	16	West	No	16	0	<50%	Standby	All	Yes	•	•	•	•	•	•	1	2	•	9	Cove	1.22	0.91	Act mill	Unknown/stat	Unknown/stat
123	LS	Yes	1340	1341	After 1300	Ebb	•	0.03	16	West	No	16	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	2	•	9	Cove	1.22	1.52	Act mill	Unknown/stat	Unknown/stat
123	LS	Yes	1300	1302	Before 1300	Ebb	•	0.03	16	West	No	16	0	<50%	Standby	Standby	Yes	•	200	•	•	•	•	2	1	8	5	Cons	0.61	0.91	Act mill	East	East
123	LS	Yes	1331	1335	After 1300	Ebb	•	0.03	16	West	No	16	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	4	3	•	9	Cove	1.22	0.91	Act mill	West	West
123	LS	Yes	1144	1145	Before 1300	Flood	•	0.03	16	West	No	16	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	90	6	Cons	•	•	Act mill	Unknown/stat	Unknown/stat
123	LS	Yes	1208	1209	Before 1300	Flood	•	0.03	16	West	No	16	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	3	•	6	Cons	2.13	3.05	Act mill	Unknown/stat	Unknown/stat
123	LS	Yes	1359	1400	After 1300	Ebb	•	0.03	16	West	No	16	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	2	200	14	Cove	1.22	•	Act mill	Unknown/stat	Unknown/stat
123	LS	Yes	1135	1136	Before 1300	Flood	•	0.03	16	West	No	16	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	5	9	Cove	1.22	1.22	Act mill	Unknown/stat	Unknown/stat
123	LS	Yes	1345	1347	After 1300	Ebb	•	0.03	16	West	No	16	0	<50%	Standby	All	Yes	•	•	•	•	•	•	2	2	100	11	Cove	0.91	1.22	Polar	East	East
123	LS	Yes	1356	1357	After 1300	Ebb	•	0.03	16	West	No	16	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	2	250	12	Cove	0.91	•	Act mill	East	East
123	LS	Yes	1118	1120	Before 1300	Flood	•	0.03	16	West	No	16	0	<50%	Standby	All	Yes	•	•	•	•	•	•	2	1	20	9	Cove	0.91	0.91	Act mill	West	West
123	LS	Yes	1436	1443	After 1300	Ebb	•	0.03	16	West	No	17	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	7	3	•	9	Cove	1.83	1.22	Act mill	West	West
123	LS	Yes	1402	1407	After 1300	Ebb	•	0.03	16	West	No	17	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	5	2	•	14	Cove	1.22	3.96	Act mill	Unknown/stat	Unknown/stat
123	LS	Yes	1420	1421	After 1300	Ebb	•	0.03	16	West	No	17	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	7	12	Cove	0.61	0.91	Act mill	West	West
123	LS	Yes	1431	1434	After 1300	Ebb	•	0.03	16	West	No	17	0	<50%	Standby	All	Yes	•	•	•	•	•	•	3	1	25	11	Cove	1.22	1.52	Act mill	Unknown/stat	Unknown/stat
123	LS	Yes	1427	1428	After 1300	Ebb	•	0.03	16	West	No	17	0	<50%	Standby	All	Yes	•	•	•	•	•	•	1	1	6	11	Cove	0.61	0.91	Act mill	West	West
123	LS	Yes	1414	1415	After 1300	Ebb	•	0.03	16	West	No	17	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	2	•	14	Cove	1.52	0.91	Act mill	Unknown/stat	Unknown/stat
123	LS	Yes	1510	1518	After 1300	Ebb	•	0.03	16	West	No	17	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	8	3	•	6	Cons	3.96	•	Act mill	Unknown/stat	Unknown/stat
123	LS	Yes	1503	1505	After 1300	Ebb	•	0.03	16	West	No	17	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	2	2	•	6	Cons	•	•	Act mill	East	East
123	LS	No	1606	1607	After 1300	Ebb	•	0.03	16	West	No	18	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	60	8	Cove	0.91	1.22	Polar	South	East
123	LS	Yes	1100	1102	Before 1300	Flood	•	0.03	16	West	No	18	0	<50%	Standby	All	Yes	•	•	•	•	•	•	2	1	35	14	Cove	0.61	•	Act mill	North	West
123	LS	No	1602	1606	After 1300	Ebb	•	0.03	16	West	No	18	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	4	1	50	8	Cove	0.91	0.91	Polar	West	West
123	LS	Yes	1534	1540	After 1300	Ebb	•	0.03	16	West	No	18	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	6	3	•	5	Cons	3.96	•	Act mill	East	East
123	LS	Yes	1545	1546	After 1300	Ebb	•	0.03	16	West	No	18	0	<50%	Standby	All	Yes	400	150	•	•	•	•	1	1	20	2	Cons	•	•	Act mill	Unknown/stat	Unknown/stat
123	LS	Yes	1114	1116	Before 1300	Flood	•	0.03	16	West	No	18	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	2	1	13	12	Cove	0.61	1.22	Act mill	West	West
123	LS	Yes	1107	1109	Before 1300	Flood	•	0.03	16	West	No	18	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	2	2	250	14	Cove	0.91	0.91	Act mill	West	West
124	BF	Yes	1243	1244	Before 1300	Flood	•	0.00	0	•	No	18	0	<50%	None	None	No	•	•	•	•	•	•	1	1	•	12	Cove	0.61	1.52	Act mill	East	East
124	BF	Yes	1245	1248	Before 1300	Flood	•	0.00	0	•	No	18	0	<50%	None	None	No	•	•	•	•	•	•	3	2	•	12	Cove	0.91	2.44	Act mill	East	East
124	BF	Yes	1231	1233	Before 1300	Flood	•	0.00	0	•	No	18	0	<50%	None	None	No	•	•	•	•	•	•	2	2	•	14	Cove	1.83	3.05	Pa mill	Unknown/stat	Unknown/stat
124	BF	Yes	1228	1230	Before 1300	Flood	•	0.00	0	•	No	18	0	<50%	None	None	No	•	•	•	•	•	•	2	1	•	14	Cove	1.83	3.05	Pa mill	Unknown/stat	Unknown/stat
124	BF	Yes	1235	1236	Before 1300	Flood	•	0.00	0	•	No	18	0	<50%	None	None	No	•	•	•	•	•	•	1	1	•	14	Cove	0.91	2.44	Polar	South	East
124	BF	Yes	1237	1242	Before 1300	Flood	•	0.00	0	•	No	18	0	<50%	None	None	No	•	•	•	•	•	•	5	1	•	14	Cove	1.22	2.13	Pa mill	Unknown/stat	Unknown/stat
124	BF	Yes	1302	1303	After 1300	Flood	•	0.00	0	•	No	21	0	<50%	None	None	No	•	•	•	•	•	•	1	1	•	9	Cove	0.91	2.44	Pa mill	Unknown/stat	Unknown/stat
124	BF	Yes	1303	1305	After 1300	Flood	•	0.00	0	•	No	21	0	<50%	None	None	No	•	•	•	•	•	•	2	1	•	9	Cove	0.91	3.05	Pa mill	Unknown/stat	Unknown/stat
124	BF	Yes	1248	1252	Before 1300	Flood	•	0.00	0	•	No	21	0	<50%	None	None	No	•	•	•	•	•	•	4	2	•	11	Cove	0.91	1.83	Act mill	East	East
124	BF	Yes	1254	1255	Before 1300	Flood	•	0.00	0	•	No	21	0	<50%	None	None	No	•	•	•	•	•	•	1	1	•	9	Cove	1.22	2.44	Pa mill	Unknown/stat	Unknown/stat
124	BF	Yes	1306	1309	After 1300	Flood	•	0.00	0	•	No	21	0	<50%	None	None	No	•	•	•	•	•	•	3	2	•	8	Cove	0.61	1.52	Polar	South	East
124	BF	Yes	1257	1258	Before 1300	Flood	•	0.00	0	•	No	21	0	<50%	None	None	No	•	•	•	•	•	•	1	1	•	9	Cove	1.22	2.44	Pa mill	Unknown/stat	Unknown/stat
124	BF	Yes	1256	1257	Before 1300	Flood	•	0.00	0	•	No	21	0	<50%	None	None	No	•	•	•	•	•	•	1	1	•	9	Cove	0.91	1.83	Pa mill	Unknown/stat	Unknown/stat
124	BF	Yes	1259	1300	Before 1300	Flood	•	0.00	0	•	No	21	0	<50%	None	None	No	•	•	•	•	•	•	1	2	•	9	Cove	1.52	1.83	Pa mill	Unknown/stat	Unknown/stat
124	BF	Yes	1305	1306	After 1300	Flood	•	0.00	0	•	No	21	0	<50%	None	None	No	•	•	•	•	•	•	1	1	•	8	Cove	0.91	3.05	Polar	North	West
124	BF	Yes	1312	1313	After 1300	Flood	•	0.06	0	•	No	21	0	<50%	None	None	No	•	•	•	•	•	•	1	1	•	6	Cons	1.83	4.57	Polar	West	West
124	BF	Yes	1316	1317	After 1300	Flood	•	0.06	0	•	No	21	0	<50%	None	None	No	•	•	•	•	•	•	1	1	•	6	Cons	0.61	3.05	Pa mill	Unknown/stat	Unknown/stat
124	BF	Yes	1332	1337	After 1300	Flood	•	0.00	8	South	No	21	0	<50%	None	None	No	•	•	•	•	•	•	5	2	•	5	Cons	3.05	6.10	Polar	South	East
124	BF	Yes	1339	1345	After 1300	Flood	•	0.00	8	South	No	21	0	<50%	None	None	No	•	•	•	•	•	•	6	2	•	5	Cons	3.66	7.62	Pa mill	Unknown/stat	Unknown/stat
124	KK	No	810	812	Before 1300	Ebb	•	0.00	8	West	No	•	0	<50%	None	Standby	No	•	•	•	•	•	•	2	1	•	6	Cons	1.52	1.52	Pa mill	Unknown/stat	Unknown/stat
124	LC	Yes	1359	1402	After 1300	Flood	•	0.00	16	West	No	21	0	<50%	None	None	No	•	•	•	•	•	•	3	1	•	11	Cove	1.52	1.83	Act mill	East	East

J.D.	ID	Round	Start	Stop	AM/PM	T. Stg	Tide	Wave	Wd	—>	Rain	Air	Clds	Clds 2	DB State	60 State	Drive	DB Pile	60 Pile	DB Sh	60 Sh	DB -Z	60-Z	Obs'	#'s	Actual	Zone	Area	Depth	Shore	Behav	Behav Dir	Behav Dir 2
124	LC	Yes	1345	1346	After 1300	Flood	•	0.00	16	West	No	21	0	<50%	None	None	No	•	•	•	•	•	•	1	1	5	12	Cove	1.22	1.52	Act mill	West	West
124	LC	Yes	1455	1500	After 1300	Ebb	•	0.00	16	West	No	21	0	<50%	None	None	No	•	•	•	•	•	•	5	2	•	5	Cons	2.13	1.52	Polar	East	East
124	LC	Yes	1415	1420	After 1300	Flood	•	0.00	16	West	No	21	0	<50%	None	None	No	•	•	•	•	•	•	5	2	•	9	Cove	2.44	2.44	Act mill	West	West
124	LC	Yes	1337	1338	After 1300	Flood	•	0.00	16	West	No	21	0	<50%	None	None	No	•	•	•	•	•	•	1	1	50	14	Cove	•	•	Act mill	North	West
124	LC	No	1615	1616	After 1300	Ebb	•	0.00	16	West	No	21	0	<50%	None	None	No	•	•	•	•	•	•	1	2	•	5	Cons	•	•	Act mill	Unknown/stat	Unknown/stat
124	LC	No	1515	1516	After 1300	Ebb	•	0.00	16	West	No	21	0	<50%	None	None	No	•	•	•	•	•	•	1	1	30	5	Cons	•	•	Act mill	West	West
124	LC	Yes	1332	1333	After 1300	Flood	•	0.00	16	West	No	21	0	<50%	None	None	No	•	•	•	•	•	•	1	1	7	14	Cove	1.22	0.91	Act mill	North	West
124	LC	Yes	1330	1331	After 1300	Flood	•	0.00	16	West	No	21	0	<50%	None	None	No	•	•	•	•	•	•	1	1	2	14	Cove	0.61	0.91	Act mill	North	West
124	LC	Yes	1445	1446	After 1300	Ebb	•	0.00	16	West	No	21	0	<50%	None	None	No	•	•	•	•	•	•	1	2	•	6	Cons	1.22	•	Pa mill	Unknown/stat	Unknown/stat
124	LC	Yes	1435	1440	After 1300	Flood	•	0.00	16	West	No	21	0	<50%	None	None	No	•	•	•	•	•	•	5	2	•	6	Cons	1.22	2.13	Polar	East	East
124	LC	Yes	1422	1425	After 1300	Flood	•	0.00	16	West	No	21	0	<50%	None	None	No	•	•	•	•	•	•	3	2	•	9	Cove	1.22	1.83	Act mill	West	West
124	LC	No	1528	1530	After 1300	Ebb	•	0.00	16	West	No	21	0	<50%	None	None	No	•	•	•	•	•	•	2	2	•	5	Cons	1.83	2.13	Polar	West	West
124	LC	Yes	1350	1351	After 1300	Flood	•	0.00	16	West	No	21	0	<50%	None	None	No	•	•	•	•	•	•	1	1	12	12	Cove	1.22	1.52	Pa mill	Unknown/stat	Unknown/stat
124	LC	Yes	1405	1406	After 1300	Flood	•	0.00	16	West	No	21	0	<50%	None	None	No	•	•	•	•	•	•	1	1	2	9	Cove	1.22	1.52	Pa mill	Unknown/stat	Unknown/stat
124	LC	No	1527	1531	After 1300	Ebb	•	0.00	16	West	No	21	0	<50%	None	None	No	•	•	•	•	•	•	4	2	•	5	Cons	1.83	•	Act mill	West	West
124	LC	Yes	1410	1411	After 1300	Flood	•	0.00	16	West	No	21	0	<50%	None	None	No	•	•	•	•	•	•	1	2	•	9	Cove	2.13	•	Pa mill	Unknown/stat	Unknown/stat
124	LC	Yes	1353	1355	After 1300	Flood	•	0.00	16	West	No	21	0	<50%	None	None	No	•	•	•	•	•	•	2	1	30	11	Cove	•	2.13	Act mill	Unknown/stat	Unknown/stat
124	LC	No	1507	1510	After 1300	Ebb	•	0.00	16	West	No	21	0	<50%	None	None	No	•	•	•	•	•	•	3	1	•	5	Cons	0.91	•	Act mill	West	West
124	LC	Yes	1505	1506	After 1300	Ebb	•	0.00	16	West	No	21	0	<50%	None	None	No	•	•	•	•	•	•	1	1	•	5	Cons	•	1.52	Polar	West	West
124	LC	Yes	1355	1358	After 1300	Flood	•	0.00	16	West	No	21	0	<50%	None	None	No	•	•	•	•	•	•	3	1	20	11	Cove	1.52	2.44	Act mill	West	West
124	LC	No	1510	1514	After 1300	Ebb	•	0.00	16	West	No	21	0	<50%	None	None	No	•	•	•	•	•	•	4	2	•	5	Cons	1.22	1.52	Polar	East	East
127	BF	Yes	1101	1102	Before 1300	Flood	•	0.15	8	SE	Yes	7	100	>50%	Standby	Standby	No	•	•	•	•	•	•	1	1	•	6	Cons	1.52	3.05	Polar	East	East
127	BF	Yes	952	956	Before 1300	Ebb	•	0.15	8	SE	No	7	100	>50%	None	Standby	No	•	•	•	•	•	•	4	1	•	5	Cons	0.31	0.61	Pa mill	Unknown/stat	Unknown/stat
127	BF	Yes	1031	1033	Before 1300	Flood	•	0.15	8	SE	No	7	100	>50%	Standby	Standby	No	•	•	•	•	•	•	2	1	•	3	Cons	0.31	0.91	Pa mill	Unknown/stat	Unknown/stat
127	BF	Yes	1144	1154	Before 1300	Flood	•	0.15	8	SE	Yes	7	100	>50%	Standby	Standby	No	•	•	•	•	•	•	10	2	•	6	Cons	1.22	3.05	Pa mill	Unknown/stat	Unknown/stat
127	BF	Yes	1122	1124	Before 1300	Flood	•	0.15	8	SE	Yes	7	100	>50%	Standby	Standby	No	•	•	•	•	•	•	2	2	•	6	Cons	0.91	2.44	Pa mill	Unknown/stat	Unknown/stat
127	BF	Yes	1033	1036	Before 1300	Ebb	•	0.15	8	SE	No	7	100	>50%	Standby	Standby	No	•	•	•	•	•	•	3	1	•	3	Cons	0.91	•	Pa mill	Unknown/stat	Unknown/stat
127	BF	Yes	946	948	Before 1300	Ebb	•	0.15	8	SE	Yes	7	100	>50%	None	Standby	No	•	•	•	•	•	•	2	1	100	5	Cons	0.31	0.61	Pa mill	Unknown/stat	Unknown/stat
127	BF	Yes	1043	1046	Before 1300	Flood	•	0.15	8	SE	Yes	7	100	>50%	Standby	Standby	No	•	•	•	•	•	•	3	1	•	5	Cons	0.31	0.91	Pa mill	Unknown/stat	Unknown/stat
127	BF	Yes	1134	1144	Before 1300	Flood	•	0.15	8	SE	Yes	7	100	>50%	Standby	Standby	No	•	•	•	•	•	•	10	2	•	6	Cons	0.91	1.83	Pa mill	Unknown/stat	Unknown/stat
127	BF	Yes	1102	1115	Before 1300	Flood	•	0.15	8	SE	Yes	7	100	>50%	Standby	Standby	No	•	•	•	•	•	•	13	1	•	6	Cons	0.91	2.44	Act mill	East	East
127	BF	Yes	1047	1048	Before 1300	Flood	•	0.15	8	SE	No	7	100	>50%	Standby	Standby	No	•	•	•	•	•	•	1	1	•	5	Cons	0.61	0.91	Polar	East	East
127	BF	Yes	1027	1029	Before 1300	Ebb	•	0.15	8	SE	Yes	7	100	>50%	None	Standby	No	•	•	•	•	•	•	2	1	•	2	Cons	0.61	0.91	Pa mill	Unknown/stat	Unknown/stat
127	BF	Yes	958	1002	Before 1300	Ebb	•	0.15	8	SE	No	7	100	>50%	None	Standby	No	•	•	•	•	•	•	4	2	•	5	Cons	0.61	0.61	Pa mill	Unknown/stat	Unknown/stat
127	BF	Yes	949	950	Before 1300	Ebb	•	0.15	8	SE	No	7	100	>50%	None	Standby	No	•	•	•	•	•	•	1	1	•	5	Cons	1.52	3.66	Polar	West	West
127	BF	Yes	1051	1059	Before 1300	Flood	•	0.15	8	SE	No	7	100	>50%	Standby	Standby	No	•	•	•	•	•	•	8	2	•	5	Cons	0.91	3.05	Pa mill	Unknown/stat	Unknown/stat
127	BF	Yes	1015	1021	Before 1300	Ebb	•	0.15	8	SE	No	7	100	>50%	None	Standby	No	•	•	•	•	•	•	6	1	55	4	Cons	0.31	0.61	Pa mill	Unknown/stat	Unknown/stat
127	BF	Yes	1004	1010	Before 1300	Ebb	•	0.15	8	SE	Yes	7	100	>50%	None	Standby	No	•	•	•	•	•	•	6	1	•	5	Cons	0.61	1.52	Polar	West	West
127	BF	Yes	941	944	Before 1300	Ebb	•	0.15	3	SE	No	10	100	>50%	None	None	No	•	•	•	•	•	•	3	1	•	5	Cons	0.91	1.52	Polar	East	East
127	BF	Yes	926	933	Before 1300	Ebb	•	0.15	3	SE	No	10	100	>50%	None	None	No	•	•	•	•	•	•	7	3	•	6	Cons	0.61	1.52	Pa mill	Unknown/stat	Unknown/stat
127	BF	Yes	935	939	Before 1300	Ebb	•	0.15	3	SE	No	10	100	>50%	None	None	No	•	•	•	•	•	•	4	2	•	6	Cons	1.22	3.05	Pa mill	Unknown/stat	Unknown/stat
127	LC	Yes	1435	1436	After 1300	Flood	•	0.00	8	West	No	13	60	>50%	None	None	No	•	•	•	•	•	•	1	1	•	9	Cove	1.22	2.44	Act mill	West	West
127	LC	Yes	1437	1438	After 1300	Flood	•	0.00	8	West	No	13	60	>50%	None	None	No	•	•	•	•	•	•	1	2	•	9	Cove	0.61	0.61	Pa mill	Unknown/stat	Unknown/stat
127	LC	Yes	1425	1426	After 1300	Flood	•	0.00	8	West	No	13	60	>50%	None	None	No	•	•	•	•	•	•	1	1	5	10	Cove	1.52	2.44	Polar	West	West
127	LC	Yes	1445	1446	After 1300	Flood	•	0.00	8	West	No	13	60	>50%	None	None	No	•	•	•	•	•	•	1	2	•	9	Cove	1.22	0.61	Pa mill	Unknown/stat	Unknown/stat
127	LC	Yes	1427	1429	After 1300	Flood	•	0.00	8	West	No	13	60	>50%	None	None	No	•	•	•	•	•	•	2	2	•	10	Cove	1.52	0.91	Polar	West	West
127	LC	Yes	1420	1421	After 1300	Flood	•	0.00	8	West	No	13	60	>50%	None	None	No	•	•	•	•	•	•	1	1	55	11	Cove	1.22	1.22	Act mill	West	West
127	LC	Yes	1410	1414	After 1300	Flood	•	0.03	8	West	No	13	80	>50%	None	None	No	•	•	•	•	•	•	4	1	15	13	Cove	0.61	1.22	Polar	East	East
127	LC	Yes	1405	1406	After 1300	Flood	•	0.03	8	West	No	13	80	>50%	None	None	No	•	•	•	•	•	•	1	1	15	14	Cove	1.22	0.91	Polar	West	West
127	LC	Yes	1416	1417	After 1300	Flood	•	0.03	8	West	No	13	80	>50%	None	None	No	•	•	•	•	•	•	1	1	15	11	Cove	0.61	1.22	Act mill	West	West
127	LC	No	1606	1607	After 1300	Flood	•	0.00	0	•	No	16	50	>50%	None	None	No	•	•	•	•	•	•	1	1	•	5	Cons	1.52	1.52	Act mill	West	West
127	LC	Yes	1458	1459	After 1300	Flood	•	0.00	8	West	No	16	50	>50%	None	None	No	•	•	•	•	•	•	1	1	•	7	Cons	2.74	3.05	Pa mill	Unknown/stat	Unknown/stat

AR010153

J.D.	ID	Round	Start	Stop	AM/PM	T. Stg	Tide	Wave	Wd	—>	Rain	Air	Clds	Clds 2	DB State	60 State	Drive	DB Pile	60 Pile	DB Sh	60 Sh	DB-Z	60-Z	Obs'	#'s	Actual	Zone	Area	Depth	Shore	Behav	Behav Dir	Behav Dir 2
127	LC	No	1605	1606	After 1300	Flood	•	0.00	8	West	No	16	50	>50%	None	None	No	•	•	•	•	•	•	1	1	•	5	Cons	1.52	2.13	Act mill	West	West
127	LC	Yes	1450	1451	After 1300	Flood	•	0.00	8	West	No	16	50	>50%	None	None	No	•	•	•	•	•	•	1	1	•	9	Cove	•	0.91	Pa mill	Unknown/stat	Unknown/stat
127	LC	Yes	1530	1531	After 1300	Flood	•	0.00	8	West	No	16	50	>50%	None	None	No	•	•	•	•	•	•	1	1	•	5	Cons	6.10	4.57	Pa mill	Unknown/stat	Unknown/stat
127	LC	Yes	1522	1525	After 1300	Flood	•	0.00	8	West	No	16	50	>50%	None	None	No	•	•	•	•	•	•	3	1	•	6	Cons	•	•	Act mill	East	East
127	LC	Yes	1559	1600	After 1300	Flood	•	0.00	8	West	No	16	50	>50%	None	None	No	•	•	•	•	•	•	1	1	•	3	Cons	1.22	0.91	Pa mill	Unknown/stat	Unknown/stat
127	LC	No	1601	1602	After 1300	Flood	•	0.00	8	West	No	16	50	>50%	None	None	No	•	•	•	•	•	•	1	1	•	4	Cons	0.91	1.22	Act mill	West	West
127	LC	Yes	1531	1532	After 1300	Flood	•	0.00	8	West	No	16	50	>50%	None	None	No	•	•	•	•	•	•	1	1	•	5	Cons	3.05	4.57	Pa mill	Unknown/stat	Unknown/stat
127	LC	Yes	1527	1528	After 1300	Flood	•	0.00	8	West	No	16	50	>50%	None	None	No	•	•	•	•	•	•	1	1	•	5	Cons	6.10	4.57	Polar	East	East
127	LC	Yes	1517	1518	After 1300	Flood	•	0.00	8	West	No	16	50	>50%	None	None	No	•	•	•	•	•	•	1	1	•	7	Cons	1.22	•	Polar	East	East
127	LC	Yes	1514	1515	After 1300	Flood	•	0.00	8	West	No	16	50	>50%	None	None	No	•	•	•	•	•	•	1	1	•	7	Cons	2.44	3.05	Polar	East	East
127	LC	Yes	1447	1448	After 1300	Flood	•	0.00	8	West	No	16	50	>50%	None	None	No	•	•	•	•	•	•	1	2	•	9	Cove	•	•	Pa mill	Unknown/stat	Unknown/stat
127	LC	Yes	1501	1502	After 1300	Flood	•	0.03	8	West	No	16	50	>50%	None	None	No	•	•	•	•	•	•	1	1	•	7	Cons	1.83	3.05	Pa mill	Unknown/stat	Unknown/stat
127	LC	Yes	1505	1506	After 1300	Flood	•	0.03	8	West	No	16	50	>50%	None	None	No	•	•	•	•	•	•	1	1	•	7	Cons	3.05	3.66	Pa mill	Unknown/stat	Unknown/stat
127	LC	Yes	1507	1508	After 1300	Flood	•	0.03	8	West	No	16	50	>50%	None	None	No	•	•	•	•	•	•	1	1	•	7	Cons	3.05	3.05	Act mill	East	East
128	BF	No	1127	1132	Before 1300	Flood	•	0.00	3	West	No	•	0	<50%	All	All	Yes	•	40	•	•	•	•	5	2	•	3	Cons	0.31	1.52	Polar	West	West
128	BF	No	1053	1057	Before 1300	Ebb	•	0.00	3	West	No	•	0	<50%	All	Standby	Yes	•	40	•	•	•	•	4	2	•	2	Cons	0.61	2.44	Polar	West	West
128	BF	No	1058	1104	Before 1300	Flood	•	0.00	3	West	No	•	0	<50%	Standby	All	Yes	•	30	•	•	•	•	6	2	•	2	Cons	0.61	3.05	Act mill	West	West
128	BF	No	1109	1110	Before 1300	Flood	•	0.00	3	West	No	•	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	2	•	4	Cons	0.91	3.05	Act mill	West	West
128	BF	No	1106	1108	Before 1300	Flood	•	0.00	3	West	No	•	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	2	2	•	3	Cons	0.91	3.05	Pa mill	Unknown/stat	Unknown/stat
128	KK	Yes	901	902	Before 1300	Ebb	•	0.00	0	•	No	•	0	<50%	All	Standby	Yes	•	•	•	•	•	•	1	1	2	11	Cove	0.31	0.31	Polar	West	West
128	KK	Yes	922	923	Before 1300	Ebb	•	0.00	0	•	No	•	0	<50%	Standby	All	Yes	•	•	•	•	•	•	1	2	•	9	Cove	0.61	0.61	Polar	West	West
128	KK	Yes	907	909	Before 1300	Ebb	•	0.00	0	•	No	•	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	2	1	•	11	Cove	0.31	0.31	Act mill	West	West
128	KK	Yes	917	918	Before 1300	Ebb	•	0.00	0	•	No	•	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	•	9	Cove	0.31	0.31	Act mill	West	West
128	KK	Yes	914	915	Before 1300	Ebb	•	0.00	0	•	No	•	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	•	9	Cove	0.31	0.31	Act mill	West	West
128	KK	Yes	912	913	Before 1300	Ebb	•	0.00	0	•	No	•	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	•	9	Cove	0.31	0.31	Act mill	West	West
128	KK	Yes	904	905	Before 1300	Ebb	•	0.00	0	•	No	•	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	•	11	Cove	0.31	0.31	Polar	West	West
128	KK	Yes	918	919	Before 1300	Ebb	•	0.00	0	•	No	•	0	<50%	Standby	All	Yes	•	•	•	•	•	•	1	1	•	9	Cove	0.61	0.61	Pa mill	Unknown/stat	Unknown/stat
128	KK	Yes	858	859	Before 1300	Ebb	•	0.00	0	•	No	•	0	<50%	All	Standby	Yes	•	•	•	•	•	•	1	1	•	11	Cove	0.31	0.31	Polar	West	West
128	KK	Yes	1023	1024	Before 1300	Ebb	•	0.00	3	West	No	•	0	<50%	All	All	Yes	300	40	•	•	•	•	1	2	•	4	Cons	0.61	1.52	Polar	East	East
128	KK	Yes	1016	1019	Before 1300	Ebb	•	0.00	3	West	No	•	0	<50%	Standby	Standby	Yes	200	90	•	•	•	•	3	1	•	5	Cons	0.31	1.52	Pa mill	Unknown/stat	Unknown/stat
128	KK	Yes	1011	1015	Before 1300	Ebb	•	0.00	3	West	No	•	0	<50%	Standby	Standby	Yes	200	100	•	•	•	•	4	1	•	5	Cons	0.31	0.91	Act mill	West	West
128	KK	Yes	1030	1035	Before 1300	Ebb	•	0.00	3	West	No	•	0	<50%	All	All	Yes	300	40	•	•	•	•	5	2	•	4	Cons	0.31	0.31	Pa mill	Unknown/stat	Unknown/stat
128	KK	Yes	925	926	Before 1300	Ebb	•	0.00	3	West	No	•	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	•	9	Cove	0.91	0.91	Polar	East	East
128	KK	Yes	937	941	Before 1300	Ebb	•	0.00	3	West	No	•	0	<50%	Standby	Standby	Yes	150	400	•	•	•	•	4	2	•	6	Cons	0.91	1.83	Polar	East	East
128	KK	Yes	835	841	Before 1300	Ebb	•	0.00	8	East	No	•	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	6	1	•	14	Cove	0.31	0.31	Act mill	West	West
128	KK	Yes	845	849	Before 1300	Ebb	•	0.00	8	East	No	•	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	4	2	•	12	Cove	0.31	0.31	Act mill	West	West
128	KK	Yes	852	853	Before 1300	Ebb	•	0.00	8	East	No	•	0	<50%	All	All	Yes	•	•	•	•	•	•	1	1	•	12	Cove	0.31	0.61	Polar	West	West
128	LS	Yes	830	832	Before 1300	Ebb	•	0.03	8	East	No	13	5	<50%	Standby	Standby	Yes	•	•	•	•	•	•	2	1	45	6	Cons	0.61	0.91	Polar	West	West
128	LS	Yes	934	940	Before 1300	Ebb	•	0.03	8	East	No	13	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	6	1	6	4	Cons	0.31	0.61	Polar	West	West
128	LS	Yes	905	913	Before 1300	Ebb	•	0.03	8	East	No	13	2	<50%	Standby	All	Yes	•	•	•	•	•	•	8	1	•	4	Cons	0.61	0.61	Polar	West	West
128	LS	Yes	1000	1010	Before 1300	Ebb	•	0.03	2	West	No	14	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	10	2	•	5	Cons	1.22	•	Act mill	Unknown/stat	Unknown/stat
128	LS	Yes	1025	1030	Before 1300	Ebb	•	0.03	2	West	No	14	0	<50%	All	All	Yes	•	•	•	•	•	•	5	1	25	5	Cons	3.05	4.57	Act mill	West	West
128	LS	Yes	949	951	Before 1300	Ebb	•	0.03	2	West	No	14	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	2	2	•	6	Cons	3.05	3.05	Act mill	Unknown/stat	Unknown/stat
128	LS	Yes	1036	1038	Before 1300	Ebb	•	0.03	3	West	No	14	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	2	2	700	5	Cons	9.14	6.10	Act mill	Unknown/stat	Unknown/stat
128	LS	Yes	1108	1112	Before 1300	Flood	•	0.03	3	West	No	14	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	4	1	30	10	Cove	0.91	0.91	Act mill	West	West
128	LS	Yes	1053	1054	Before 1300	Ebb	•	0.03	3	West	No	14	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	20	14	Cove	0.31	•	Act mill	Unknown/stat	Unknown/stat
128	LS	Yes	1116	1117	Before 1300	Flood	•	0.00	8	West	No	15	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	20	9	Cove	0.61	0.91	Act mill	West	West
128	LS	Yes	1112	1113	Before 1300	Flood	•	0.00	8	West	No	15	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	15	10	Cove	0.91	1.52	Act mill	West	West
128	LS	Yes	1124	1126	Before 1300	Flood	•	0.00	8	West	No	15	0	<50%	Standby	All	Yes	•	•	•	•	•	•	2	2	200	9	Cove	1.83	0.91	Act mill	Unknown/stat	Unknown/stat
128	LS	Yes	1214	1216	Before 1300	Flood	•	0.00	3	SW	No	16	0	<50%	All	Standby	Yes	•	•	•	•	•	•	2	1	•	5	Cons	0.61	1.52	Polar	East	East
128	LS	Yes	1231	1233	Before 1300	Flood	•	0.00	3	SW	No	16	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	2	1	60	3	Cons	1.22	2.13	Act mill	East	East
128	LS	Yes	1228	1229	Before 1300	Flood	•	0.00	3	SW	No	16	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	30	3	Cons	0.91	1.52	Act mill	East	East

J.D.	ID	Round	Start	Stop	AM/PM	T. Stg	Tide	Wave	Wd	—>	Rain	Air	Clds	Clds 2	DB State	60 State	Drive	DB Pile	60 Pile	DB Sh	60 Sh	DB -Z	60-Z	Obs'	#'s	Actual	Zone	Area	Depth	Shore	Behav	Behav Dir	Behav Dir 2
128	LS	Yes	1143	1150	Before 1300	Flood	•	0.00	6	West	No	16	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	7	1	40	6	Cons	3.05	6.10	Act mill	Unknown/stat	Unknown/stat
128	LS	Yes	1157	1201	Before 1300	Flood	•	0.00	6	West	No	16	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	4	1	50	6	Cons	5.18	9.14	Act mill	Unknown/stat	Unknown/stat
128	LS	Yes	1202	1205	Before 1300	Flood	•	0.00	6	West	No	16	0	<50%	All	Standby	Yes	•	•	•	•	•	•	3	2	125	6	Cons	1.22	3.05	Act mill	Unknown/stat	Unknown/stat
128	LS	Yes	1336	1337	After 1300	Flood	•	0.00	11	SW	No	16	0	<50%	All	Standby	Yes	•	•	•	•	•	•	1	1	40	12	Cove	0.91	1.22	Act mill	Unknown/stat	Unknown/stat
128	LS	Yes	1326	1334	After 1300	Flood	•	0.00	11	SW	No	16	0	<50%	All	Standby	Yes	•	•	•	•	•	•	8	1	50	14	Cove	0.91	0.91	Act mill	Unknown/stat	Unknown/stat
128	LS	Yes	1339	1340	After 1300	Flood	•	0.00	11	SW	No	16	0	<50%	All	All	Yes	•	•	•	•	•	•	1	1	17	12	Cove	0.61	1.52	Act mill	West	West
128	LS	Yes	1356	1400	After 1300	Flood	•	0.03	13	West	No	16	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	4	1	18	9	Cove	0.61	0.91	Polar	West	West
128	LS	Yes	1348	1350	After 1300	Flood	•	0.03	13	West	No	16	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	2	1	95	9	Cove	0.31	0.31	Act mill	Unknown/stat	Unknown/stat
128	LS	Yes	1343	1344	After 1300	Flood	•	0.03	13	West	No	16	0	<50%	All	Standby	Yes	•	•	•	•	•	•	1	1	90	11	Cove	0.61	0.61	Act mill	Unknown/stat	Unknown/stat
128	LS	Yes	1445	1446	After 1300	Flood	•	0.03	16	SW	No	16	0	<50%	Standby	Standby	Yes	•	150	•	•	•	•	1	1	25	4	Cons	0.61	1.83	Act mill	West	West
128	LS	Yes	1440	1441	After 1300	Flood	•	0.03	16	SW	No	16	0	<50%	Standby	Standby	Yes	200	190	•	•	•	•	1	1	2	5	Cons	0.61	0.61	Pa mill	Unknown/stat	Unknown/stat
128	LS	Yes	1437	1438	After 1300	Flood	•	0.03	16	SW	No	16	0	<50%	Standby	Standby	Yes	200	200	•	•	•	•	1	1	80	5	Cons	1.22	2.44	Act mill	Unknown/stat	Unknown/stat
128	LS	Yes	1408	1409	After 1300	Flood	•	0.06	16	SW	No	16	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	40	9	Cove	1.22	2.44	Polar	West	West
128	LS	Yes	1402	1405	After 1300	Flood	•	0.06	16	SW	No	16	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	3	2	100	9	Cove	•	•	Act mill	West	West
128	LS	Yes	1423	1425	After 1300	Flood	•	0.15	16	SW	No	16	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	2	2	200	6	Cons	6.10	9.14	Act mill	Unknown/stat	Unknown/stat
128	LS	Yes	1456	1457	After 1300	Flood	•	0.03	6	SW	No	16	0	<50%	Standby	Standby	Yes	320	40	•	•	•	•	1	2	175	4	Cons	1.83	0.91	Act mill	West	West
128	LS	Yes	1451	1452	After 1300	Flood	•	0.03	6	SW	No	16	0	<50%	All	All	Yes	300	120	•	•	•	•	1	1	80	4	Cons	1.83	3.35	Act mill	West	West
128	LS	Yes	1554	1555	After 1300	Flood	•	0.00	8	West	No	17	0	<50%	Standby	All	Yes	•	•	•	•	•	•	1	2	400	14	Cove	0.91	2.44	Act mill	Unknown/stat	Unknown/stat
128	LS	Yes	1551	1552	After 1300	Flood	•	0.00	8	West	No	17	0	<50%	All	Standby	Yes	•	•	•	•	•	•	1	1	30	12	Cove	1.22	1.83	Act mill	Unknown/stat	Unknown/stat
128	LS	Yes	1548	1549	After 1300	Flood	•	0.00	8	West	No	17	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	20	12	Cove	0.91	0.91	Act mill	East	East
128	LS	Yes	1536	1537	After 1300	Flood	•	0.03	8	West	No	17	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	15	11	Cove	0.61	0.91	Act mill	Unknown/stat	Unknown/stat
128	LS	Yes	1540	1542	After 1300	Flood	•	0.03	8	West	No	17	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	2	2	300	11	Cove	1.22	1.83	Polar	East	East
128	LS	Yes	1531	1532	After 1300	Flood	•	0.03	8	SW	No	17	0	<50%	All	Standby	Yes	•	•	•	•	•	•	1	1	15	9	Cove	1.52	3.05	Act mill	West	West
128	LS	Yes	1522	1530	After 1300	Flood	•	0.03	8	SW	No	17	0	<50%	All	Standby	Yes	•	•	•	•	•	•	8	1	40	9	Cove	1.22	0.91	Act mill	Unknown/stat	Unknown/stat
128	LS	Yes	1546	1547	After 1300	Flood	•	0.03	8	West	No	17	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	9	12	Cove	0.91	1.22	Polar	East	East
128	LS	Yes	1533	1535	After 1300	Flood	•	0.03	8	SW	No	17	0	<50%	All	Standby	Yes	•	•	•	•	•	•	2	2	125	10	Cove	0.91	1.22	Polar	West	West
128	LS	Yes	1513	1514	After 1300	Flood	•	0.03	8	SW	No	17	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	15	7	Cons	1.52	2.44	Polar	West	West
128	LS	Yes	1511	1512	After 1300	Flood	•	0.03	8	SW	No	17	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	25	6	Cons	•	•	Act mill	Unknown/stat	Unknown/stat
128	LS	Yes	1517	1518	After 1300	Flood	•	0.03	8	SW	No	17	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	10	8	Cove	0.61	1.52	Act mill	North	West
129	LC	Yes	1532	1533	After 1300	Flood	•	0.30	•	•	No	18	0	<50%	Standby	All	Yes	•	300	•	•	•	•	1	1	•	2	Cons	0.91	•	Act mill	East	East
129	LC	Yes	1526	1527	After 1300	Flood	•	0.30	•	•	No	18	0	<50%	Standby	Standby	Yes	•	600	•	•	•	•	1	1	•	2	Cons	0.91	0.31	Pa mill	Unknown/stat	Unknown/stat
129	LC	No	1615	1617	After 1300	Flood	•	0.30	•	•	No	18	0	<50%	All	All	Yes	•	•	•	•	•	•	2	1	•	6	Cons	•	•	Act mill	West	West
129	LC	No	1553	1554	After 1300	Flood	•	0.30	•	•	No	18	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	2	•	2	Cons	1.22	1.22	Act mill	West	West
129	LC	No	1546	1547	After 1300	Flood	•	0.30	•	•	No	18	0	<50%	Standby	Standby	Yes	•	300	•	•	•	•	1	1	•	2	Cons	1.22	1.22	Act mill	West	West
129	LC	Yes	1504	1505	After 1300	Flood	•	0.30	•	•	No	18	0	<50%	All	Standby	Yes	•	•	•	•	•	•	1	2	•	8	Cove	•	•	Act mill	North	West
129	LC	Yes	1420	1424	After 1300	Flood	•	•	•	•	No	18	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	4	1	•	12	Cove	1.22	•	Polar	West	West
129	LC	Yes	1501	1502	After 1300	Flood	•	•	•	•	No	18	0	<50%	All	Standby	Yes	•	•	•	•	•	•	1	1	•	8	Cove	2.13	2.44	Act mill	North	West
129	LC	Yes	1425	1426	After 1300	Flood	•	•	•	•	No	18	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	•	12	Cove	0.91	1.22	Act mill	West	West
129	LC	Yes	1414	1417	After 1300	Flood	•	•	•	•	No	18	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	3	1	35	13	Cove	1.22	2.44	Polar	West	West
129	LC	Yes	1449	1455	After 1300	Flood	•	•	•	•	No	18	0	<50%	All	Standby	Yes	•	•	•	•	•	•	6	3	•	9	Cove	3.05	3.05	Pa mill	Unknown/stat	Unknown/stat
129	LC	Yes	1447	1448	After 1300	Flood	•	•	•	•	No	18	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	2	•	9	Cove	0.91	1.52	Act mill	West	West
129	LC	Yes	1431	1432	After 1300	Flood	•	•	•	•	No	18	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	•	11	Cove	0.61	0.61	Act mill	West	West
129	LC	Yes	1445	1446	After 1300	Flood	•	•	•	•	No	18	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	2	•	10	Cove	1.83	1.22	Act mill	West	West
129	LC	Yes	1430	1431	After 1300	Flood	•	•	•	•	No	18	0	<50%	Standby	All	Yes	•	•	•	•	•	•	1	1	•	11	Cove	0.91	0.61	Pa mill	Unknown/stat	Unknown/stat
129	LC	Yes	1405	1411	After 1300	Flood	•	•	•	•	No	18	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	6	1	10	14	Cove	1.22	0.61	Act mill	North	West
129	LC	Yes	1404	1405	After 1300	Flood	•	•	•	•	No	18	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	10	14	Cove	1.22	3.05	Pa mill	Unknown/stat	Unknown/stat
129	LC	Yes	1436	1439	After 1300	Flood	•	•	•	•	No	18	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	3	1	•	10	Cove	•	1.22	Act mill	West	West
129	LC	Yes	1400	1401	After 1300	Flood	•	•	•	•	No	18	0	<50%	Standby	All	Yes	•	•	•	•	•	•	1	1	10	14	Cove	0.91	2.44	Act mill	North	West
129	LC	Yes	1427	1428	After 1300	Flood	•	•	•	•	No	18	0	<50%	Standby	All	Yes	•	•	•	•	•	•	1	1	•	12	Cove	3.05	4.57	Act mill	West	West
129	LC	Yes	1443	1444	After 1300	Flood	•	•	•	•	No	18	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	•	10	Cove	0.91	1.52	Act mill	West	West
129	LC	Yes	1433	1435	After 1300	Flood	•	•	•	•	No	18	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	2	2	•	11	Cove	0.61	0.31	Polar	West	West
129	LC	Yes	1358	1359	After 1300	Flood	•	•	•	•	No	18	0	<50%	All	All	Yes	•	•	•	•	•	•	1	1	10	14	Cove	1.52	2.44	Pa mill	Unknown/stat	Unknown/stat

J.D.	ID	Round	Start	Stop	AM/PM	T. Stg	Tide	Wave	Wd	—>	Rain	Air	Clds	Clds 2	DB State	60 State	Drive	DB Pile	60 Pile	DB Sh	60 Sh	DB -Z	60-Z	Obs'	#'s	Actual	Zone	Area	Depth	Shore	Behav	Behav Dir	Behav Dir 2
129	LC	Yes	1441	1442	After 1300	Flood	•	•	•	•	No	18	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	•	10	Cove	0.91	1.22	Act mill	West	West
130	LS	Yes	1347	1351	After 1300	Flood	•	0.00	8	SW	No	10	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	4	1	13	12	Cove	0.31	0.31	Act mill	Unknown/stat	Unknown/stat
130	LS	Yes	1354	1355	After 1300	Flood	•	0.00	8	SW	No	10	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	•	11	Cove	0.61	2.13	Act mill	Unknown/stat	Unknown/stat
130	LS	Yes	1327	1329	After 1300	Flood	•	0.00	8	SW	No	10	100	>50%	All	Standby	Yes	•	•	•	•	•	•	2	1	8	14	Cove	0.31	1.52	Act mill	Unknown/stat	Unknown/stat
130	LS	Yes	1320	1321	After 1300	Flood	•	0.03	8	SW	No	10	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	13	13	Cove	0.31	•	Act mill	Unknown/stat	Unknown/stat
130	LS	Yes	1300	1306	Before 1300	Flood	•	0.03	8	SW	No	10	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	6	2	125	9	Cove	0.91	0.91	Act mill	Unknown/stat	Unknown/stat
130	LS	Yes	1245	1247	Before 1300	Flood	•	0.03	8	SW	No	10	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	2	2	150	6	Cons	0.91	•	Act mill	East	East
130	LS	Yes	1230	1238	Before 1300	Flood	•	0.03	16	West	No	10	100	>50%	Standby	All	Yes	•	•	•	•	•	•	8	2	100	5	Cons	2.74	3.66	Act mill	Unknown/stat	Unknown/stat
130	LS	Yes	1228	1229	Before 1300	Flood	•	0.03	16	West	No	10	100	>50%	All	Standby	Yes	300	50	380	80	•	180	1	1	•	5	Cons	0.91	1.52	Act mill	West	West
130	LS	Yes	1209	1210	Before 1300	Flood	•	0.03	16	West	No	10	100	>50%	Standby	Standby	Yes	260	30	•	•	•	•	1	1	•	5	Cons	0.61	1.52	Act mill	West	West
130	LS	Yes	1357	1358	After 1300	Flood	•	0.00	3	West	No	13	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	6	11	Cove	0.31	0.61	Act mill	West	West
130	LS	Yes	1114	1115	Before 1300	Ebb	•	0.00	3	West	No	13	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	2	11	Cove	0.61	0.61	Act mill	Unknown/stat	Unknown/stat
130	LS	No	1530	1531	After 1300	Flood	•	0.00	3	West	No	13	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	10	14	Cove	0.31	0.61	Act mill	Unknown/stat	Unknown/stat
130	LS	Yes	1401	1402	After 1300	Flood	•	0.00	3	West	No	13	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	•	11	Cove	0.31	0.61	Act mill	Unknown/stat	Unknown/stat
130	LS	No	1515	1517	After 1300	Flood	•	0.00	3	West	No	13	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	2	2	•	9	Cove	1.22	1.52	Act mill	Unknown/stat	Unknown/stat
130	LS	Yes	1405	1406	After 1300	Flood	•	0.00	3	West	No	13	100	>50%	All	All	Yes	•	•	•	•	•	•	1	2	100	9	Cove	0.91	1.22	Act mill	Unknown/stat	Unknown/stat
130	LS	Yes	1122	1125	Before 1300	Ebb	•	0.00	3	West	No	13	100	>50%	All	Standby	Yes	•	•	•	•	•	•	3	2	400	9	Cove	0.91	1.83	Act mill	Unknown/stat	Unknown/stat
130	LS	No	1525	1528	After 1300	Flood	•	0.00	3	West	No	13	100	>50%	Standby	Standby	Yes	500	100	•	•	•	•	3	1	•	3	Cons	0.91	1.52	Act mill	East	East
130	LS	Yes	1408	1412	After 1300	Flood	•	0.00	8	West	No	13	100	>50%	All	Standby	Yes	•	•	•	•	•	•	4	2	250	9	Cove	1.22	1.83	Act mill	Unknown/stat	Unknown/stat
130	LS	Yes	1424	1425	After 1300	Flood	•	0.00	8	West	No	13	100	>50%	Standby	All	Yes	300	300	•	•	•	•	1	2	100	7	Cons	3.05	3.05	Act mill	Unknown/stat	Unknown/stat
130	LS	Yes	1417	1418	After 1300	Flood	•	0.00	8	West	No	13	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	2	100	8	Cove	0.91	1.52	Act mill	Unknown/stat	Unknown/stat
130	LS	Yes	1448	1449	After 1300	Flood	•	0.03	8	West	No	13	100	>50%	All	Standby	Yes	300	•	•	•	•	•	1	2	•	5	Cons	1.22	2.44	Act mill	Unknown/stat	Unknown/stat
130	LS	Yes	1436	1440	After 1300	Flood	•	0.03	8	West	No	13	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	4	2	300	6	Cons	4.57	7.62	Act mill	Unknown/stat	Unknown/stat
130	LS	Yes	1430	1432	After 1300	Flood	•	0.03	8	West	No	13	100	>50%	Standby	Standby	Yes	300	280	•	•	•	•	2	2	•	6	Cons	1.52	3.66	Act mill	Unknown/stat	Unknown/stat
130	LS	No	1505	1506	After 1300	Flood	•	0.03	8	West	No	13	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	70	8	Cove	1.52	•	Act mill	Unknown/stat	Unknown/stat
130	LS	No	1513	1515	After 1300	Flood	•	0.03	8	West	No	13	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	2	1	18	9	Cove	0.31	0.31	Act mill	Unknown/stat	Unknown/stat
130	LS	Yes	1450	1452	After 1300	Flood	•	0.03	8	West	No	13	100	>50%	Standby	All	Yes	300	100	•	•	•	•	2	1	15	5	Cons	1.22	3.05	Act mill	Unknown/stat	Unknown/stat
130	LS	Yes	1205	1208	Before 1300	Flood	•	0.06	16	SW	No	13	100	>50%	Standby	Standby	Yes	250	30	•	•	•	•	3	1	13	5	Cons	0.61	1.83	Act mill	East	East
130	LS	Yes	1145	1149	Before 1300	Ebb	•	0.06	16	SW	No	13	100	>50%	Standby	All	Yes	•	•	•	•	•	•	4	2	•	9	Cove	0.91	2.13	Act mill	Unknown/stat	Unknown/stat
130	LS	Yes	1158	1159	Before 1300	Ebb	•	0.06	16	SW	No	13	100	>50%	Standby	Standby	Yes	200	80	•	•	•	•	1	1	11	5	Cons	0.31	0.91	Act mill	Unknown/stat	Unknown/stat
131	KK	No	730	800	Before 1300	Ebb	•	0.00	8	East	No	•	100	>50%	None	None	No	•	•	•	•	•	•	30	2	•	9	Cove	1.22	3.05	Pa mill	Unknown/stat	Unknown/stat
131	LC	Yes	1445	1446	After 1300	Flood	•	0.00	•	•	No	16	95	>50%	None	None	No	•	•	•	•	•	•	1	1	•	3	Cons	0.91	1.83	Act mill	West	West
131	LC	Yes	1404	1405	After 1300	Flood	•	0.00	•	•	No	16	95	>50%	None	None	No	•	•	•	•	•	•	1	1	70	11	Cove	0.61	3.35	Pa mill	Unknown/stat	Unknown/stat
131	LC	Yes	1432	1437	After 1300	Flood	•	0.00	•	•	No	16	95	>50%	None	None	No	•	•	•	•	•	•	5	3	•	6	Cons	1.52	2.13	Pa mill	Unknown/stat	Unknown/stat
131	LC	Yes	1400	1401	After 1300	Flood	•	0.00	•	•	No	16	95	>50%	None	None	No	•	•	•	•	•	•	1	1	•	14	Cove	0.91	1.22	Pa mill	Unknown/stat	Unknown/stat
131	LC	Yes	1411	1412	After 1300	Flood	•	0.00	•	•	No	16	95	>50%	None	None	No	•	•	•	•	•	•	1	1	•	9	Cove	2.13	3.05	Pa mill	Unknown/stat	Unknown/stat
131	LC	Yes	1418	1419	After 1300	Flood	•	0.00	•	•	No	16	95	>50%	None	None	No	•	•	•	•	•	•	1	1	2	9	Cove	2.44	3.66	Pa mill	Unknown/stat	Unknown/stat
134	BF	Yes	1000	1011	Before 1300	Ebb	•	0.00	0	•	No	10	100	>50%	Standby	Standby	No	•	•	•	•	•	•	11	2	•	6	Cons	0.91	2.13	Pa mill	Unknown/stat	Unknown/stat
134	BF	Yes	1251	1253	Before 1300	Ebb	•	0.00	0	•	No	10	100	>50%	Standby	Standby	No	•	•	•	•	•	•	2	1	80	10	Cove	0.61	2.13	Pa mill	Unknown/stat	Unknown/stat
134	BF	Yes	1253	1254	Before 1300	Ebb	•	0.00	0	•	No	10	100	>50%	Standby	Standby	No	•	•	•	•	•	•	1	1	•	11	Cove	0.61	1.83	Pa mill	Unknown/stat	Unknown/stat
134	BF	Yes	1023	1038	Before 1300	Ebb	•	0.00	0	•	No	10	100	>50%	Standby	Standby	No	•	•	•	•	•	•	15	3	•	9	Cove	2.74	9.14	Pa mill	Unknown/stat	Unknown/stat
134	BF	Yes	1107	1110	Before 1300	Ebb	•	0.00	0	•	No	10	100	>50%	Standby	Standby	No	•	•	•	•	•	•	3	2	•	14	Cove	1.83	4.57	Pa mill	Unknown/stat	Unknown/stat
134	BF	Yes	1022	1023	Before 1300	Ebb	•	0.00	0	•	No	10	100	>50%	Standby	Standby	No	•	•	•	•	•	•	1	1	15	9	Cove	0.31	0.91	Polar	East	East
134	BF	Yes	1015	1016	Before 1300	Ebb	•	0.00	0	•	No	10	100	>50%	Standby	Standby	No	•	•	•	•	•	•	1	1	2	7	Cons	1.83	3.66	Polar	West	West
134	BF	Yes	1105	1107	Before 1300	Ebb	•	0.00	0	•	No	10	100	>50%	Standby	Standby	No	•	•	•	•	•	•	2	2	•	14	Cove	0.91	2.13	Pa mill	Unknown/stat	Unknown/stat
134	BF	Yes	1053	1058	Before 1300	Ebb	•	0.00	0	•	No	10	100	>50%	Standby	Standby	No	•	•	•	•	•	•	5	3	•	12	Cove	•	3.05	Pa mill	Unknown/stat	Unknown/stat
134	BF	Yes	1255	1256	Before 1300	Ebb	•	0.00	0	•	No	10	100	>50%	Standby	Standby	No	•	•	•	•	•	•	1	1	•	11	Cove	1.22	•	Polar	East	East
134	BF	Yes	1058	1103	Before 1300	Ebb	•	0.00	0	•	No	10	100	>50%	Standby	Standby	No	•	•	•	•	•	•	5	3	•	14	Cove	0.61	1.83	Pa mill	Unknown/stat	Unknown/stat
134	BF	Yes	1042	1051	Before 1300	Ebb	•	0.00	0	•	No	10	100	>50%	Standby	Standby	No	•	•	•	•	•	•	9	3	•	10	Cove	0.91	3.05	Act mill	East	East
134	BF	Yes	954	959	Before 1300	Ebb	•	0.00	0	•	Yes	10	100	>50%	Standby	Standby	No	•	•	•	•	•	•	5	1	20	6	Cons	0.91	1.52	Act mill	East	East
134	BF	Yes	1259	1310	Before 1300	Ebb	•	0.00	0	•	No	10	100	>50%	Standby	Standby	No	•	•	•	•	•	•	11	2	•	13	Cove	0.31	2.44	Pa mill	Unknown/stat	Unknown/stat
134	BF	Yes	926	932	Before 1300	Ebb	•	0.03	0	•	Yes	10	100	>50%	Standby	Standby	No	•	•	•	•	•	•	6	2	100	4	Cons	0.61	1.52	Pa mill	Unknown/stat	Unknown/stat

AR010156

J.D.	ID	Round	Start	Stop	AM/PM	T. Stg	Tide	Wave	Wd	—>	Rain	Air	Clds	Clds 2	DB State	60 State	Drive	DB Pile	60 Pile	DB Sh	60 Sh	DB -Z	60-Z	Obs'	#'s	Actual	Zone	Area	Depth	Shore	Behav	Behav Dir	Behav Dir 2
134	BF	Yes	936	941	Before 1300	Ebb	•	0.03	0	•	Yes	10	100	>50%	Standby	Standby	No	•	•	•	•	•	•	5	2	•	5	Cons	1.22	1.83	Pa mill	Unknown/stat	Unknown/stat
134	BF	Yes	941	946	Before 1300	Ebb	•	0.03	0	•	Yes	10	100	>50%	Standby	Standby	No	•	•	•	•	•	•	5	3	1000	5	Cons	0.91	2.44	Pa mill	Unknown/stat	Unknown/stat
134	BF	Yes	1215	1218	Before 1300	Ebb	•	0.06	0	•	No	10	100	>50%	Standby	Standby	No	•	•	•	•	•	•	3	3	•	5	Cons	1.83	4.57	Pa mill	Unknown/stat	Unknown/stat
134	BF	Yes	1245	1246	Before 1300	Ebb	•	0.06	0	•	No	10	100	>50%	Standby	Standby	No	•	•	•	•	•	•	1	2	•	9	Cove	1.22	2.44	Act mill	East	East
134	BF	Yes	1233	1241	Before 1300	Ebb	•	0.06	0	•	No	10	100	>50%	Standby	Standby	No	•	•	•	•	•	•	8	3	•	9	Cove	2.44	4.57	Pa mill	Unknown/stat	Unknown/stat
134	BF	Yes	1221	1223	Before 1300	Ebb	•	0.06	0	•	No	10	100	>50%	Standby	Standby	No	•	•	•	•	•	•	2	2	100	6	Cons	0.91	2.44	Polar	West	West
134	BF	Yes	1121	1124	Before 1300	Ebb	•	0.06	0	•	No	10	100	>50%	Standby	Standby	No	•	•	•	•	•	•	3	2	•	1	Cons	1.22	1.83	Pa mill	Unknown/stat	Unknown/stat
134	BF	Yes	1152	1159	Before 1300	Ebb	•	0.06	0	•	No	10	100	>50%	Standby	Standby	No	•	•	•	•	•	•	7	3	•	5	Cons	0.91	3.35	Pa mill	Unknown/stat	Unknown/stat
134	BF	Yes	1129	1135	Before 1300	Ebb	•	0.06	0	•	No	10	100	>50%	Standby	Standby	No	•	•	•	•	•	•	6	2	•	1	Cons	3.05	3.05	Act mill	East	East
134	BF	Yes	1140	1145	Before 1300	Ebb	•	0.06	0	•	No	10	100	>50%	Standby	Standby	No	•	•	•	•	•	•	5	2	•	3	Cons	0.91	1.83	Act mill	East	East
134	BF	Yes	1242	1245	Before 1300	Ebb	•	0.06	0	•	No	10	100	>50%	Standby	Standby	No	•	•	•	•	•	•	3	2	•	9	Cove	0.91	1.83	Pa mill	Unknown/stat	Unknown/stat
134	LC	Yes	1415	1420	After 1300	Ebb	•	0.00	•	•	No	16	100	>50%	Standby	Standby	No	•	•	•	•	•	•	5	2	•	9	Cove	1.83	3.05	Pa mill	Unknown/stat	Unknown/stat
134	LC	Yes	1545	1546	After 1300	Flood	•	0.00	•	•	No	16	100	>50%	None	None	No	•	•	•	•	•	•	1	1	•	5	Cons	•	•	Pa mill	Unknown/stat	Unknown/stat
134	LC	Yes	1405	1407	After 1300	Ebb	•	0.00	•	•	No	16	100	>50%	Standby	Standby	No	•	•	•	•	•	•	2	1	•	10	Cove	0.91	1.83	Act mill	West	West
134	LC	Yes	1410	1411	After 1300	Ebb	•	0.00	•	•	No	16	100	>50%	Standby	Standby	No	•	•	•	•	•	•	1	2	•	9	Cove	•	1.22	Pa mill	Unknown/stat	Unknown/stat
134	LC	Yes	1345	1347	After 1300	Ebb	•	0.00	•	•	No	16	100	>50%	Standby	Standby	No	•	•	•	•	•	•	2	1	•	14	Cove	0.61	2.13	Polar	North	West
134	LC	Yes	1350	1355	After 1300	Ebb	•	0.00	•	•	No	16	100	>50%	Standby	Standby	No	•	•	•	•	•	•	5	1	•	12	Cove	0.91	3.66	Act mill	West	West
134	LC	Yes	1600	1601	After 1300	Flood	•	0.00	•	•	No	16	100	>50%	None	None	No	•	•	•	•	•	•	1	1	•	5	Cons	0.61	0.91	Pa mill	Unknown/stat	Unknown/stat
134	LC	Yes	1420	1427	After 1300	Ebb	•	0.00	•	•	No	16	100	>50%	Standby	Standby	No	•	•	•	•	•	•	7	2	•	9	Cove	1.83	3.66	Pa mill	Unknown/stat	Unknown/stat
134	LC	Yes	1601	1602	After 1300	Flood	•	0.06	•	•	No	16	100	>50%	None	None	No	•	•	•	•	•	•	1	1	•	5	Cons	1.22	1.83	Polar	West	West
135	LS	Yes	•	•	After 1300	Ebb	•	0.03	8	South	No	9	100	>50%	Standby	Standby	Yes	230	180	•	•	•	•	•	1	50	5	Cons	1.22	3.05	Act mill	Unknown/stat	Unknown/stat
135	LS	Yes	•	•	After 1300	Ebb	•	0.03	8	South	No	9	100	>50%	All	Standby	Yes	220	200	•	•	•	•	•	2	700	6	Cons	3.05	6.10	Act mill	Unknown/stat	Unknown/stat
135	LS	Yes	•	•	After 1300	Ebb	•	0.03	8	SE	No	9	100	>50%	All	Standby	Yes	•	•	•	•	•	•	•	2	200	8	Cove	0.61	1.52	Act mill	South	East
135	LS	Yes	•	•	After 1300	Ebb	•	0.03	8	SE	No	9	100	>50%	All	Standby	Yes	250	250	•	•	•	•	•	2	80	5	Cons	0.61	1.52	Act mill	Unknown/stat	Unknown/stat
135	LS	Yes	•	•	After 1300	Ebb	•	0.03	8	South	No	9	100	>50%	All	Standby	Yes	230	110	•	•	•	•	•	1	40	5	Cons	1.22	2.44	Act mill	Unknown/stat	Unknown/stat
135	LS	Yes	•	•	After 1300	Ebb	•	0.03	16	West	No	9	100	>50%	All	Standby	Yes	•	•	•	•	•	•	•	2	150	12	Cove	0.91	1.83	Act mill	Unknown/stat	Unknown/stat
135	LS	Yes	•	•	After 1300	Ebb	•	0.03	16	West	No	9	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	•	1	20	12	Cove	0.61	0.61	Polar	East	East
135	LS	Yes	•	•	After 1300	Ebb	•	0.03	16	West	No	9	100	>50%	All	Standby	Yes	•	•	•	•	•	•	•	1	50	12	Cove	0.91	1.52	Act mill	Unknown/stat	Unknown/stat
135	LS	Yes	•	•	After 1300	Ebb	•	0.00	6	West	No	10	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	•	1	12	14	Cove	1.52	0.61	Act mill	Unknown/stat	Unknown/stat
135	LS	Yes	•	•	After 1300	Ebb	•	0.00	6	West	No	10	100	>50%	All	Standby	Yes	•	•	•	•	•	•	•	3	•	9	Cove	1.83	2.44	Act mill	Unknown/stat	Unknown/stat
135	LS	Yes	•	•	After 1300	Ebb	•	0.00	6	West	No	10	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	•	2	100	11	Cove	0.61	0.61	Act mill	Unknown/stat	Unknown/stat
135	LS	Yes	•	•	After 1300	Ebb	•	0.00	8	South	No	10	100	>50%	All	Standby	Yes	•	•	•	•	•	•	•	1	10	14	Cove	0.61	1.52	Act mill	West	West
135	LS	Yes	•	•	After 1300	Ebb	•	0.00	8	South	No	10	100	>50%	All	Standby	Yes	•	•	•	•	•	•	•	1	•	14	Cove	0.91	1.52	Act mill	South	East
135	LS	Yes	•	•	After 1300	Ebb	•	0.00	8	South	No	10	100	>50%	All	Standby	Yes	•	•	•	•	•	•	•	2	•	14	Cove	1.22	2.44	Act mill	Unknown/stat	Unknown/stat
135	LS	Yes	•	•	After 1300	Ebb	•	0.03	8	West	No	10	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	•	1	80	6	Cons	0.61	0.91	Polar	East	East
135	LS	Yes	•	•	After 1300	Ebb	•	0.03	8	West	No	10	100	>50%	Standby	Standby	Yes	280	280	•	•	•	•	•	1	30	6	Cons	0.61	0.61	Polar	East	East
135	LS	Yes	•	•	After 1300	Ebb	•	0.03	8	West	No	10	100	>50%	All	Standby	Yes	•	•	•	•	•	•	•	1	40	8	Cove	0.31	1.22	Polar	West	West
135	LS	Yes	•	•	After 1300	Ebb	•	0.03	8	West	No	10	100	>50%	All	Standby	Yes	250	220	•	•	•	•	•	3	•	5	Cons	1.52	4.88	Act mill	East	East
135	LS	Yes	•	•	After 1300	Ebb	•	0.03	8	West	No	10	100	>50%	Standby	All	Yes	•	•	•	•	•	•	•	2	100	7	Cons	0.61	0.91	Polar	North	West
135	LS	Yes	•	•	After 1300	Ebb	•	0.03	16	SE	No	10	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	•	3	•	9	Cove	2.13	4.27	Act mill	Unknown/stat	Unknown/stat
135	LS	Yes	•	•	After 1300	Ebb	•	0.03	16	SE	No	10	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	•	2	600	12	Cove	0.91	•	Act mill	Unknown/stat	Unknown/stat
135	LS	Yes	•	•	After 1300	Ebb	•	0.03	13	West	No	13	80	>50%	Standby	Standby	Yes	•	•	•	•	•	•	•	1	2	10	Cove	0.31	0.61	Act mill	East	East
135	LS	Yes	•	•	After 1300	Ebb	•	0.03	13	West	No	13	80	>50%	Standby	Standby	Yes	•	•	•	•	•	•	•	2	150	9	Cove	0.61	0.91	Act mill	Unknown/stat	Unknown/stat
135	LS	Yes	•	•	After 1300	Ebb	•	0.03	13	West	No	13	80	>50%	All	Standby	Yes	•	•	•	•	•	•	•	1	20	11	Cove	0.61	0.91	Polar	Unknown/stat	Unknown/stat
135	LS	Yes	•	•	After 1300	Ebb	•	0.03	13	West	No	13	80	>50%	Standby	Standby	Yes	•	•	•	•	•	•	•	1	8	9	Cove	0.91	1.52	Polar	West	West
135	LS	Yes	•	•	After 1300	Ebb	•	0.03	13	West	No	13	100	>50%	Standby	All	Yes	250	180	•	•	•	•	•	2	125	5	Cons	•	•	Polar	East	East
135	LS	Yes	•	•	After 1300	Ebb	•	0.03	13	West	No	13	100	>50%	Standby	Standby	Yes	250	200	•	•	•	•	•	3	•	5	Cons	2.13	4.57	Act mill	Unknown/stat	Unknown/stat
135	LS	Yes	•	•	After 1300	Ebb	•	0.00	13	West	No	14	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	•	1	15	14	Cove	0.31	0.61	Act mill	Unknown/stat	Unknown/stat
135	LS	Yes	•	•	After 1300	Ebb	•	0.00	13	West	No	14	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	•	1	35	14	Cove	0.91	3.05	Act mill	Unknown/stat	Unknown/stat
135	LS	Yes	•	•	After 1300	Ebb	•	0.00	13	West	No	14	95	>50%	Standby	Standby	Yes	•	•	•	•	•	•	•	1	30	14	Cove	•	•	Act mill	South	East
135	LS	Yes	•	•	After 1300	Ebb	•	0.00	16	South	No	14	80	>50%	All	Standby	Yes	•	•	•	•	•	•	•	2	100	11	Cove	1.52	2.13	Act mill	East	East
135	LS	Yes	•	•	After 1300	Ebb	•	0.00	16	South	No	14	80	>50%	All	Standby	Yes	•	•	•	•	•	•	•	2	100	11	Cove	1.22	1.22	Act mill	East	East

J.D.	ID	Round	Start	Stop	AM/PM	T. Stg	Tide	Wave	Wd	—>	Rain	Air	Clds	Clds 2	DB State	60 State	Drive	DB Pile	60 Pile	DB Sh	60 Sh	DB -Z	60-Z	Obs'	#'s	Actual	Zone	Area	Depth	Shore	Behav	Behav Dir	Behav Dir 2
135	LS	Yes	•	•	After 1300	Ebb	•	0.00	16	South	No	14	90	>50%	All	Standby	Yes	•	•	•	•	•	•	•	2	750	12	Cove	0.31	3.96	Act mill	Unknown/stat	Unknown/stat
135	LS	Yes	•	•	After 1300	Flood	•	0.00	16	West	No	14	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	•	1	40	8	Cove	0.91	0.91	Polar	South	East
135	LS	Yes	•	•	After 1300	Flood	•	0.00	16	West	No	14	100	>50%	All	All	Yes	•	•	•	•	•	•	•	2	750	9	Cove	1.83	3.35	Act mill	Unknown/stat	Unknown/stat
135	LS	Yes	•	•	After 1300	Flood	•	0.00	16	West	No	14	100	>50%	All	Standby	Yes	•	•	•	•	•	•	•	1	40	11	Cove	0.61	1.52	Act mill	Unknown/stat	Unknown/stat
135	LS	Yes	•	•	After 1300	Flood	•	0.03	16	West	No	14	100	>50%	All	All	Yes	•	•	•	•	•	•	•	2	•	6	Cons	1.52	6.10	Act mill	Unknown/stat	Unknown/stat
135	LS	Yes	•	•	After 1300	Flood	•	0.03	16	West	No	14	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	•	1	20	8	Cove	0.91	1.22	Polar	North	West
135	LS	Yes	•	•	After 1300	Ebb	•	•	•	•	No	•	100	>50%	All	All	Yes	•	•	•	•	•	•	•	3	•	9	Cove	•	•	Polar	Unknown/stat	Unknown/stat
135	LS	Yes	•	•	After 1300	Ebb	•	•	•	•	No	•	100	>50%	All	Standby	Yes	400	•	•	•	•	•	•	2	•	8	Cove	0.91	1.83	Act mill	Unknown/stat	Unknown/stat
136	BF	Yes	1252	1258	Before 1300	Ebb	•	0.00	0	•	No	13	50	>50%	Standby	All	Yes	500	150	•	•	•	•	6	2	•	2	Cons	0.91	1.83	Pa mill	Unknown/stat	Unknown/stat
136	BF	Yes	1212	1217	Before 1300	Ebb	•	0.00	0	•	No	13	50	>50%	All	Standby	Yes	400	200	•	•	•	•	5	3	•	5	Cons	1.83	6.10	Act mill	East	East
136	BF	Yes	1156	1203	Before 1300	Ebb	•	0.00	0	•	No	13	50	>50%	All	Standby	Yes	400	200	•	•	•	•	7	3	1000	6	Cons	1.22	4.27	Pa mill	Unknown/stat	Unknown/stat
136	BF	No	950	1052	Before 1300	Ebb	•	0.00	0	•	No	13	0	<50%	All	All	Yes	•	50	•	•	•	•	62	3	•	1	Cons	1.22	3.05	Pa mill	Unknown/stat	Unknown/stat
136	BF	Yes	1138	1147	Before 1300	Ebb	•	0.00	0	•	No	13	50	>50%	Standby	Standby	Yes	•	•	•	•	•	•	9	3	•	9	Cove	0.91	5.18	Pa mill	Unknown/stat	Unknown/stat
136	BF	Yes	1204	1210	Before 1300	Ebb	•	0.00	0	•	No	13	50	>50%	All	Standby	Yes	400	200	•	•	•	•	6	2	100	6	Cons	0.91	3.66	Act mill	East	East
136	BF	Yes	1134	1135	Before 1300	Ebb	•	0.00	0	•	No	13	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	2	10	Cove	0.61	2.44	Act mill	East	East
136	BF	Yes	1128	1129	Before 1300	Ebb	•	0.00	0	•	No	13	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	50	12	Cove	0.91	2.44	Act mill	West	West
136	BF	Yes	1300	1307	Before 1300	Ebb	•	0.00	0	•	No	13	25	<50%	Standby	Standby	Yes	•	•	•	•	•	•	7	3	•	1	Cons	1.52	2.13	Pa mill	Unknown/stat	Unknown/stat
136	BF	Yes	1127	1128	Before 1300	Ebb	•	0.00	0	•	No	13	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	3	12	Cove	0.31	1.52	Polar	West	West
136	BF	Yes	1300	1303	Before 1300	Ebb	•	0.00	0	•	No	13	50	>50%	Standby	Standby	Yes	•	•	•	•	•	•	3	2	•	1	Cons	0.91	3.05	Pa mill	Unknown/stat	Unknown/stat
136	BF	Yes	1238	1247	Before 1300	Ebb	•	0.00	0	•	No	13	50	>50%	Standby	Standby	Yes	350	60	•	•	•	•	9	2	200	4	Cons	1.22	1.52	Act mill	East	East
136	BF	Yes	1230	1231	Before 1300	Ebb	•	0.00	0	•	No	13	50	>50%	Standby	Standby	Yes	400	80	•	•	•	•	1	2	200	5	Cons	0.91	2.44	Polar	West	West
136	BF	Yes	1224	1225	Before 1300	Ebb	•	0.00	0	•	No	13	50	>50%	Standby	Standby	Yes	400	180	•	•	•	•	1	1	6	5	Cons	0.61	1.22	Pa mill	Unknown/stat	Unknown/stat
136	LC	Yes	1330	1331	After 1300	Ebb	•	0.00	•	•	No	16	50	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	•	12	Cove	0.91	2.44	Polar	West	West
136	LC	Yes	1316	1320	After 1300	Ebb	•	0.00	•	•	No	16	60	>50%	Standby	Standby	Yes	•	•	•	•	•	•	4	1	•	13	Cove	0.31	1.52	Pa mill	Unknown/stat	Unknown/stat
136	LC	Yes	1354	1355	After 1300	Ebb	•	0.00	•	•	No	16	50	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	3	•	9	Cove	1.83	1.83	Pa mill	Unknown/stat	Unknown/stat
136	LC	Yes	1325	1326	After 1300	Ebb	•	0.00	•	•	No	16	60	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	8	13	Cove	0.61	2.44	Pa mill	Unknown/stat	Unknown/stat
136	LC	Yes	1335	1336	After 1300	Ebb	•	0.00	•	•	No	16	50	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	25	12	Cove	1.52	3.05	Pa mill	Unknown/stat	Unknown/stat
136	LC	Yes	1300	1310	Before 1300	Ebb	•	0.00	•	•	No	16	60	>50%	Standby	Standby	Yes	•	•	•	•	•	•	10	1	•	14	Cove	0.91	1.83	Polar	South	East
136	LC	Yes	1343	1344	After 1300	Ebb	•	0.00	•	•	No	16	50	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	6	11	Cove	•	•	Pa mill	Unknown/stat	Unknown/stat
136	LC	Yes	1340	1343	After 1300	Ebb	•	0.00	•	•	No	16	50	>50%	Standby	Standby	Yes	•	•	•	•	•	•	3	2	•	11	Cove	1.22	3.05	Act mill	West	West
136	LC	Yes	1345	1347	After 1300	Ebb	•	0.00	•	•	No	16	50	>50%	Standby	Standby	Yes	•	•	•	•	•	•	2	1	50	9	Cove	1.22	2.13	Act mill	West	West
136	LC	Yes	1414	1415	After 1300	Ebb	•	0.00	•	•	No	16	50	>50%	Standby	Standby	Yes	300	•	•	•	•	•	1	2	•	6	Cons	0.91	2.44	Pa mill	Unknown/stat	Unknown/stat
136	LC	Yes	1425	1426	After 1300	Ebb	•	0.00	•	•	No	16	50	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	•	6	Cons	0.91	0.61	Pa mill	Unknown/stat	Unknown/stat
136	LC	Yes	1331	1334	After 1300	Ebb	•	0.00	•	•	No	16	50	>50%	Standby	All	Yes	•	•	•	•	•	•	3	1	50	12	Cove	1.22	3.05	Pa mill	Unknown/stat	Unknown/stat
136	LC	Yes	1400	1401	After 1300	Ebb	•	0.00	•	•	No	16	50	>50%	All	Standby	Yes	•	•	•	•	•	•	1	2	•	8	Cove	1.52	0.31	Pa mill	Unknown/stat	Unknown/stat
136	LC	Yes	1350	1351	After 1300	Ebb	•	0.00	•	•	No	16	50	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	2	•	9	Cove	0.91	1.83	Act mill	West	West
136	LC	Yes	1415	1420	After 1300	Ebb	•	0.00	•	•	No	16	50	>50%	Standby	Standby	Yes	•	•	•	•	•	•	5	3	•	6	Cons	2.44	4.57	Act mill	East	East
136	LC	Yes	1355	1356	After 1300	Ebb	•	0.00	•	•	No	16	50	>50%	All	Standby	Yes	•	•	•	•	•	•	1	3	•	9	Cove	4.57	6.10	Pa mill	Unknown/stat	Unknown/stat
136	LC	Yes	1402	1403	After 1300	Ebb	•	0.00	•	•	No	16	50	>50%	All	Standby	Yes	•	•	•	•	•	•	1	2	•	8	Cove	1.83	3.05	Act mill	South	East
136	LC	Yes	1347	1348	After 1300	Ebb	•	0.00	•	•	No	16	50	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	50	9	Cove	1.22	2.44	Act mill	West	West
136	LC	Yes	1430	1435	After 1300	Ebb	•	0.03	•	•	No	18	50	>50%	Standby	Standby	Yes	•	•	•	•	•	•	5	1	•	3	Cons	1.22	2.13	Act mill	East	East
136	LC	No	1435	1436	After 1300	Ebb	•	0.03	•	•	No	18	50	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	2	•	3	Cons	0.61	0.31	Polar	East	East
136	LC	No	1530	1535	After 1300	Ebb	•	0.03	•	•	No	18	50	>50%	All	Standby	Yes	•	•	•	•	•	•	5	3	•	6	Cons	0.91	3.05	Pa mill	Unknown/stat	Unknown/stat
136	LC	No	1535	1536	After 1300	Ebb	•	0.03	•	•	No	18	50	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	2	•	5	Cons	0.61	2.44	Act mill	East	East
137	LS	Yes	1045	1046	Before 1300	Ebb	•	0.00	16	East	No	12	100	>50%	All	Standby	Yes	•	•	•	•	•	•	1	1	20	12	Cove	0.61	1.22	Act mill	Unknown/stat	Unknown/stat
137	LS	Yes	1042	1043	Before 1300	Ebb	•	0.00	16	East	No	12	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	85	12	Cove	0.31	1.22	Act mill	East	East
137	LS	Yes	1034	1036	Before 1300	Ebb	•	0.00	16	East	No	12	100	>50%	Standby	All	Yes	•	•	•	•	•	•	2	1	20	14	Cove	0.31	0.91	Act mill	Unknown/stat	Unknown/stat
137	LS	Yes	1215	1230	Before 1300	Ebb	•	0.00	6	East	No	13	100	>50%	Standby	Standby	Yes	250	120	•	•	•	•	15	2	100	5	Cons	2.13	3.35	Act mill	Unknown/stat	Unknown/stat
137	LS	Yes	1124	1131	Before 1300	Ebb	•	0.00	6	East	No	13	100	>50%	Standby	Standby	Yes	250	•	•	•	•	•	7	2	150	6	Cons	1.52	3.05	Act mill	Unknown/stat	Unknown/stat
137	LS	Yes	1048	1052	Before 1300	Ebb	•	0.00	8	East	No	13	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	4	1	40	11	Cove	0.31	0.61	Act mill	Unknown/stat	Unknown/stat
137	LS	Yes	1057	1059	Before 1300	Ebb	•	0.00	8	East	No	13	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	2	1	50	10	Cove	1.22	1.22	Act mill	Unknown/stat	Unknown/stat
137	LS	Yes	1056	1057	Before 1300	Ebb	•	0.00	8	East	No	13	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	25	10	Cove	0.61	1.22	Act mill	West	West

J.D.	ID	Round	Start	Stop	AM/PM	T. Stg	Tide	Wave	Wd	—>	Rain	Air	Clds	Clds 2	DB State	60 State	Drive	DB Pile	60 Pile	DB Sh	60 Sh	DB -Z	60-Z	Obs'	#'s	Actual	Zone	Area	Depth	Shore	Behav	Behav Dir	Behav Dir 2
137	LS	Yes	1101	1107	Before 1300	Ebb	•	0.03	8	East	No	13	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	6	3	1500	9	Cove	1.22	1.83	Act mill	Unknown/stat	Unknown/stat
137	LS	Yes	1110	1111	Before 1300	Ebb	•	0.03	8	East	No	13	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	45	8	Cove	0.61	1.52	Act mill	West	West
137	LS	Yes	1116	1117	Before 1300	Ebb	•	0.03	8	East	No	13	100	>50%	All	Standby	Yes	•	•	•	•	•	•	1	1	70	8	Cove	1.22	1.52	Act mill	North	West
137	LS	Yes	1305	1307	After 1300	Ebb	•	0.03	8	North	No	14	100	>50%	All	Standby	Yes	•	•	•	•	•	•	2	1	30	14	Cove	0.31	0.91	Act mill	Unknown/stat	Unknown/stat
137	LS	Yes	1314	1320	After 1300	Ebb	•	0.03	8	North	No	14	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	6	1	55	12	Cove	0.61	0.61	Act mill	Unknown/stat	Unknown/stat
137	LS	Yes	1309	1311	After 1300	Ebb	•	0.03	8	North	No	14	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	2	1	30	14	Cove	0.31	0.91	Polar	East	East
137	LS	Yes	1329	1335	After 1300	Ebb	•	0.03	8	West	No	14	100	>50%	All	Standby	Yes	•	•	•	•	•	•	6	3	1000	9	Cove	1.52	2.44	Act mill	Unknown/stat	Unknown/stat
137	LS	Yes	1325	1327	After 1300	Ebb	•	0.03	8	West	No	14	100	>50%	Standby	All	Yes	•	•	•	•	•	•	2	2	100	9	Cove	0.61	1.22	Polar	West	West
137	LS	Yes	1344	1345	After 1300	Ebb	•	0.03	8	West	No	14	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	2	200	8	Cove	0.61	1.22	Act mill	Unknown/stat	Unknown/stat
137	LS	Yes	1410	1414	After 1300	Ebb	•	0.03	11	West	No	14	100	>50%	Standby	All	Yes	•	•	•	•	•	•	4	2	400	5	Cons	1.22	•	Act mill	Unknown/stat	Unknown/stat
137	LS	Yes	1353	1408	After 1300	Ebb	•	0.03	11	West	No	14	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	5	3	4000	9	Cove	0.91	3.05	Polar	Unknown/stat	Unknown/stat
137	LS	Yes	1352	1353	After 1300	Ebb	•	0.03	11	West	No	14	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	2	•	9	Cove	0.91	3.05	Polar	Unknown/stat	Unknown/stat
137	LS	Yes	1346	1347	After 1300	Ebb	•	0.03	11	West	No	14	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	90	8	Cove	0.61	1.22	Polar	West	West
137	LS	Yes	1602	1606	After 1300	Ebb	•	0.00	16	West	No	16	50	>50%	Standby	Standby	Yes	•	•	•	•	•	•	4	1	25	7	Cons	0.61	1.22	Act mill	North	West
137	LS	Yes	1610	1612	After 1300	Ebb	•	0.00	16	West	No	16	50	>50%	Standby	Standby	Yes	•	•	•	•	•	•	2	2	800	6	Cons	0.91	1.83	Act mill	Unknown/stat	Unknown/stat
137	LS	Yes	1504	1505	After 1300	Ebb	•	•	3	SW	No	16	90	>50%	All	All	Yes	•	•	•	•	•	•	1	2	400	6	Cons	1.22	3.05	Act mill	West	West
137	LS	Yes	1512	1513	After 1300	Ebb	•	•	3	SW	No	16	80	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	2	250	8	Cove	0.61	0.91	Act mill	Unknown/stat	Unknown/stat
137	LS	Yes	1449	1455	After 1300	Ebb	•	•	3	SW	No	16	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	6	1	35	5	Cons	1.83	•	Act mill	Unknown/stat	Unknown/stat
137	LS	Yes	1551	1553	After 1300	Ebb	•	0.03	16	West	No	16	50	>50%	Standby	Standby	Yes	•	•	•	•	•	•	2	1	30	10	Cove	•	•	Act mill	West	West
137	LS	Yes	1559	1601	After 1300	Ebb	•	0.03	16	West	No	16	50	>50%	All	Standby	Yes	•	•	•	•	•	•	2	1	27	8	Cove	0.31	0.61	Act mill	South	East
137	LS	Yes	1555	1558	After 1300	Ebb	•	0.03	16	West	No	16	50	>50%	All	Standby	Yes	•	•	•	•	•	•	3	3	1700	9	Cove	0.91	2.44	Act mill	Unknown/stat	Unknown/stat
137	LS	Yes	1523	1525	After 1300	Ebb	•	0.03	8	North	No	17	80	>50%	Standby	Standby	Yes	•	•	•	•	•	•	2	3	•	9	Cove	1.22	2.44	Act mill	Unknown/stat	Unknown/stat
137	LS	Yes	1527	1528	After 1300	Ebb	•	0.03	8	North	No	17	80	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	25	9	Cove	0.31	0.61	Polar	West	West
137	LS	Yes	1514	1518	After 1300	Ebb	•	0.03	8	North	No	17	80	>50%	Standby	Standby	Yes	•	•	•	•	•	•	4	2	400	8	Cove	•	•	Act mill	Unknown/stat	Unknown/stat
137	LS	Yes	1533	1534	After 1300	Ebb	•	0.03	8	West	No	17	70	>50%	All	Standby	Yes	•	•	•	•	•	•	1	1	10	11	Cove	0.31	0.91	Act mill	Unknown/stat	Unknown/stat
137	LS	Yes	1548	1549	After 1300	Ebb	•	0.03	8	West	No	17	50	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	7	11	Cove	0.31	0.31	Polar	West	West
137	LS	Yes	1535	1538	After 1300	Ebb	•	0.03	8	West	No	17	70	>50%	Standby	Standby	Yes	•	•	•	•	•	•	3	1	50	12	Cove	0.31	0.91	Act mill	West	West
138	LC	Yes	1440	1441	After 1300	Ebb	•	0.00	•	•	No	16	50	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	2	•	11	Cove	2.74	2.13	Act mill	West	West
138	LC	Yes	1430	1435	After 1300	Ebb	•	0.00	•	•	No	16	60	>50%	Standby	Standby	Yes	•	•	•	•	•	•	5	1	60	11	Cove	2.13	1.52	Polar	West	West
138	LC	Yes	1445	1450	After 1300	Ebb	•	0.00	•	•	No	16	50	>50%	Standby	Standby	Yes	•	•	•	•	•	•	5	2	•	9	Cove	2.13	1.83	Polar	West	West
138	LC	Yes	1349	1351	After 1300	Ebb	•	0.00	•	•	No	16	60	>50%	Standby	Standby	Yes	•	•	•	•	•	•	2	1	60	14	Cove	2.13	3.05	Polar	North	West
138	LC	Yes	1410	1411	After 1300	Ebb	•	0.00	•	•	No	16	60	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	2	•	13	Cove	3.05	3.66	Pa mill	Unknown/stat	Unknown/stat
138	LC	Yes	1442	1444	After 1300	Ebb	•	0.00	•	•	No	16	50	>50%	Standby	Standby	Yes	•	•	•	•	•	•	2	1	•	10	Cove	1.52	2.44	Polar	West	West
138	LC	Yes	1451	1455	After 1300	Ebb	•	0.03	•	•	No	16	50	>50%	All	All	Yes	•	•	•	•	•	•	4	3	•	9	Cove	2.13	2.44	Pa mill	Unknown/stat	Unknown/stat
138	LC	Yes	1455	1500	After 1300	Ebb	•	0.03	•	•	No	16	50	>50%	All	All	Yes	•	•	•	•	•	•	5	1	•	9	Cove	4.57	12.19	Pa mill	Unknown/stat	Unknown/stat
138	LC	Yes	1520	1525	After 1300	Ebb	•	0.03	•	•	No	16	70	>50%	All	Standby	Yes	•	•	•	•	•	•	5	2	•	8	Cove	•	•	Polar	East	East
141	BF	Yes	1038	1042	Before 1300	Flood	•	0.00	16	SE	No	10	0	<50%	All	Standby	Yes	•	•	•	•	•	•	4	2	200	9	Cove	0.61	0.61	Pa mill	Unknown/stat	Unknown/stat
141	BF	Yes	1030	1034	Before 1300	Flood	•	0.00	16	SE	No	10	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	4	1	20	11	Cove	0.61	0.91	Act mill	East	East
141	BF	Yes	1035	1036	Before 1300	Flood	•	0.00	16	SE	No	10	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	20	9	Cove	0.31	0.91	Act mill	East	East
141	BF	Yes	917	920	Before 1300	Flood	•	0.06	16	SE	No	10	10	<50%	Standby	Standby	Yes	350	100	•	•	•	•	3	1	20	5	Cons	0.61	1.22	Act mill	East	East
141	BF	Yes	911	915	Before 1300	Flood	•	0.06	16	SE	No	10	10	<50%	Standby	All	Yes	400	60	•	•	•	•	4	1	10	3	Cons	0.31	1.52	Act mill	East	East
141	BF	Yes	928	929	Before 1300	Flood	•	0.06	16	SE	No	10	10	<50%	Standby	Standby	Yes	450	250	•	•	•	•	1	1	50	6	Cons	0.31	1.52	Pa mill	Unknown/stat	Unknown/stat
141	BF	Yes	937	944	Before 1300	Flood	•	0.06	19	SE	No	10	10	<50%	Standby	Standby	Yes	•	•	•	•	•	•	7	2	200	9	Cove	1.52	2.74	Pa mill	Unknown/stat	Unknown/stat
141	BF	Yes	906	907	Before 1300	Flood	•	0.06	19	SE	No	10	10	<50%	Standby	Standby	Yes	400	80	•	•	•	•	1	1	10	3	Cons	0.61	2.44	Polar	East	East
141	BF	Yes	1004	1005	Before 1300	Flood	•	0.06	19	SE	No	10	10	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	4	12	Cove	0.31	1.83	Act mill	West	West
141	BF	Yes	1023	1029	Before 1300	Flood	•	0.06	19	SE	No	10	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	6	1	30	11	Cove	0.31	0.31	Polar	West	West
141	BF	Yes	1020	1021	Before 1300	Flood	•	0.06	19	SE	No	10	0	<50%	All	Standby	Yes	•	•	•	•	•	•	1	1	1	12	Cove	0.31	1.22	Pa mill	Unknown/stat	Unknown/stat
141	BF	Yes	859	900	Before 1300	Flood	•	0.06	19	SE	No	10	10	<50%	Standby	Standby	Yes	400	70	•	•	•	•	1	1	50	1	Cons	0.31	2.13	Act mill	West	West
141	BF	Yes	907	911	Before 1300	Flood	•	0.06	19	SE	No	10	10	<50%	Standby	Standby	Yes	400	60	•	•	•	•	4	1	•	3	Cons	0.61	1.22	Act mill	West	West
141	BF	Yes	937	951	Before 1300	Flood	•	0.06	19	SE	No	10	10	<50%	All	Standby	Yes	•	•	•	•	•	•	14	2	200	9	Cove	0.61	1.83	Pa mill	Unknown/stat	Unknown/stat
141	BF	Yes	937	943	Before 1300	Flood	•	0.06	19	SE	No	10	10	<50%	Standby	Standby	Yes	•	•	•	•	•	•	6	2	200	9	Cove	6.10	7.62	Pa mill	Unknown/stat	Unknown/stat
141	BF	No	1136	1150	Before 1300	Flood	•	0.00	8	West	No	16	0	<50%	All	All	Yes	400	100	•	•	•	•	14	2	100	5	Cons	0.61	1.83	Act mill	West	West

J.D.	ID	Round	Start	Stop	AM/PM	T. Stg	Tide	Wave	Wd	—>	Rain	Air	Clds	Clds 2	DB State	60 State	Drive	DB Pile	60 Pile	DB Sh	60 Sh	DB -Z	60-Z	Obs'	#'s	Actual	Zone	Area	Depth	Shore	Behav	Behav Dir	Behav Dir 2
141	BF	Yes	1119	1206	Before 1300	Flood	•	0.00	8	West	No	16	0	<50%	All	All	Yes	400	150	•	•	•	•	47	2	100	5	Cons	0.61	1.83	Pa mill	Unknown/stat	Unknown/stat
141	BF	Yes	1047	1050	Before 1300	Flood	•	0.00	8	SE	No	16	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	3	2	•	9	Cove	3.96	6.10	Pa mill	Unknown/stat	Unknown/stat
141	BF	Yes	1101	1110	Before 1300	Flood	•	0.00	8	SE	No	16	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	9	2	100	6	Cons	1.22	3.66	Pa mill	Unknown/stat	Unknown/stat
141	BF	Yes	1042	1046	Before 1300	Flood	•	0.00	8	SE	No	16	0	<50%	All	Standby	Yes	•	•	•	•	•	•	4	2	200	9	Cove	1.52	1.83	Pa mill	Unknown/stat	Unknown/stat
141	BF	No	1150	1203	Before 1300	Flood	•	0.00	8	West	No	16	0	<50%	Standby	Standby	Yes	450	50	•	•	•	•	13	2	100	3	Cons	0.91	1.83	Act mill	East	East
141	BF	No	1203	1206	Before 1300	Flood	•	0.15	8	West	No	16	0	<50%	Standby	All	Yes	450	50	•	•	•	•	3	2	•	3	Cons	1.22	2.13	Pa mill	Unknown/stat	Unknown/stat
141	LC	Yes	1545	1548	After 1300	Flood	•	0.03	•	•	No	16	80	>50%	All	Standby	Yes	•	•	•	•	•	•	3	1	12	5	Cons	0.61	0.91	Act mill	East	East
141	LC	No	1650	1655	After 1300	Ebb	•	0.03	•	•	No	16	80	>50%	Standby	Standby	Yes	•	•	•	•	•	•	5	2	•	9	Cove	3.66	3.05	Pa mill	Unknown/stat	Unknown/stat
141	LC	Yes	1430	1431	After 1300	Flood	•	0.00	•	•	No	18	40	<50%	All	Standby	Yes	•	•	•	•	•	•	1	1	•	9	Cove	4.57	12.19	Pa mill	Unknown/stat	Unknown/stat
141	LC	Yes	1419	1420	After 1300	Flood	•	0.00	•	•	No	18	40	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	•	11	Cove	2.13	3.05	Act mill	West	West
141	LC	Yes	1401	1402	After 1300	Flood	•	0.00	•	•	No	18	45	<50%	Standby	All	Yes	•	•	•	•	•	•	1	1	13	13	Cove	1.83	3.05	Act mill	West	West
141	LC	Yes	1400	1401	After 1300	Flood	•	0.00	•	•	No	18	45	<50%	Standby	All	Yes	•	•	•	•	•	•	1	1	40	13	Cove	1.22	1.83	Act mill	West	West
141	LC	Yes	1509	1515	After 1300	Flood	•	0.00	•	•	No	18	60	>50%	Standby	Standby	Yes	•	•	•	•	•	•	6	1	•	6	Cons	0.91	1.83	Pa mill	Unknown/stat	Unknown/stat
141	LC	Yes	1405	1406	After 1300	Flood	•	0.00	•	•	No	18	45	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	13	13	Cove	1.83	1.52	Polar	West	West
141	LC	Yes	1407	1408	After 1300	Flood	•	0.00	•	•	No	18	40	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	7	12	Cove	•	3.66	Act mill	West	West
141	LC	Yes	1410	1411	After 1300	Flood	•	0.00	•	•	No	18	40	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	7	12	Cove	2.44	3.05	Polar	West	West
141	LC	Yes	1424	1425	After 1300	Flood	•	0.00	•	•	No	18	40	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	50	11	Cove	2.44	4.57	Act mill	West	West
141	LC	Yes	1436	1438	After 1300	Flood	•	0.00	•	•	No	18	40	<50%	Standby	Standby	Yes	•	•	•	•	•	•	2	2	•	9	Cove	3.66	3.05	Pa mill	Unknown/stat	Unknown/stat
141	LC	Yes	1432	1436	After 1300	Flood	•	0.00	•	•	No	18	40	<50%	Standby	Standby	Yes	•	•	•	•	•	•	4	2	100	9	Cove	4.57	12.19	Pa mill	Unknown/stat	Unknown/stat
142	KK	Yes	1223	1224	Before 1300	Flood	•	0.00	5	South	No	•	80	>50%	Standby	Standby	Yes	300	90	•	•	•	•	1	1	6	3	Cons	0.31	0.31	Polar	West	West
142	KK	Yes	1312	1313	After 1300	Flood	•	0.00	5	SE	No	•	80	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	•	11	Cove	0.91	0.91	Polar	West	West
142	KK	Yes	1325	1326	After 1300	Flood	•	0.00	5	SE	No	•	80	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	•	14	Cove	0.91	1.22	Pa mill	Unknown/stat	Unknown/stat
142	KK	Yes	1217	1218	Before 1300	Flood	•	0.00	5	South	No	•	80	>50%	Standby	Standby	Yes	300	80	•	•	•	•	1	1	6	2	Cons	0.61	1.22	Polar	East	East
142	KK	Yes	1230	1231	Before 1300	Flood	•	0.00	5	South	No	•	80	>50%	Standby	Standby	Yes	270	120	•	•	•	•	1	1	4	5	Cons	0.61	1.22	Polar	West	West
142	KK	Yes	1301	1305	After 1300	Flood	•	0.00	5	SE	No	•	80	>50%	Standby	Standby	Yes	•	•	•	•	•	•	4	2	•	9	Cove	6.10	6.10	Pa mill	Unknown/stat	Unknown/stat
142	KK	Yes	1310	1311	After 1300	Flood	•	0.00	5	SE	No	•	80	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	3	9	Cove	0.91	0.91	Polar	West	West
142	KK	Yes	1317	1318	After 1300	Flood	•	0.00	5	SE	No	•	80	>50%	All	Standby	Yes	•	•	•	•	•	•	1	1	•	12	Cove	0.61	0.91	Polar	West	West
143	BF	Yes	812	821	Before 1300	Ebb	•	0.00	0	•	No	10	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	9	1	50	14	Cove	0.31	1.52	Pa mill	Unknown/stat	Unknown/stat
143	BF	Yes	812	821	Before 1300	Ebb	•	0.00	0	•	No	10	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	9	2	100	14	Cove	0.31	1.52	Act mill	North	West
143	BF	Yes	846	851	Before 1300	Ebb	•	0.06	8	West	No	10	100	>50%	Standby	Standby	Yes	400	200	•	•	•	•	5	1	75	5	Cons	0.91	3.66	Pa mill	Unknown/stat	Unknown/stat
143	BF	Yes	828	833	Before 1300	Ebb	•	0.06	8	West	No	10	100	>50%	Standby	All	Yes	•	•	•	•	•	•	5	2	100	9	Cove	5.18	7.62	Pa mill	Unknown/stat	Unknown/stat
143	BF	Yes	832	833	Before 1300	Ebb	•	0.06	8	West	No	10	100	>50%	All	Standby	Yes	•	•	•	•	•	•	1	1	4	9	Cove	0.31	0.61	Pa mill	Unknown/stat	Unknown/stat
143	BF	Yes	956	958	Before 1300	Ebb	•	0.15	11	NW	No	10	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	2	2	100	9	Cove	6.10	6.10	Pa mill	Unknown/stat	Unknown/stat
143	BF	Yes	943	950	Before 1300	Ebb	•	0.15	11	NW	No	10	100	>50%	Standby	Standby	Yes	500	400	•	•	•	•	7	1	75	6	Cons	1.52	1.52	Pa mill	Unknown/stat	Unknown/stat
143	BF	Yes	1013	1017	Before 1300	Ebb	•	0.15	11	NW	No	10	100	>50%	Standby	All	Yes	•	•	•	•	•	•	4	1	20	14	Cove	3.35	1.83	Pa mill	Unknown/stat	Unknown/stat
143	BF	Yes	1101	1104	Before 1300	Flood	•	0.00	8	West	No	13	70	>50%	All	All	Yes	•	•	•	•	•	•	3	1	20	14	Cove	0.61	2.13	Pa mill	Unknown/stat	Unknown/stat
143	BF	Yes	1138	1142	Before 1300	Flood	•	0.00	8	West	No	13	100	>50%	All	Standby	Yes	700	•	•	•	•	•	4	1	40	1	Cons	0.61	1.83	•	Unknown/stat	Unknown/stat
143	BF	Yes	1123	1126	Before 1300	Flood	•	0.00	8	West	No	13	100	>50%	Standby	Standby	Yes	500	•	•	•	•	•	3	1	50	6	Cons	0.91	2.44	Pa mill	Unknown/stat	Unknown/stat
143	LC	No	1430	1431	After 1300	Flood	•	0.00	•	•	No	•	95	>50%	All	Standby	Yes	•	•	•	•	•	•	1	1	15	6	Cons	1.52	1.83	Polar	East	East
143	LC	No	1603	1604	After 1300	Flood	•	0.06	•	•	No	•	80	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	•	6	Cons	1.83	0.91	Pa mill	Unknown/stat	Unknown/stat
143	LC	No	1550	1551	After 1300	Flood	•	0.06	•	•	No	•	80	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	•	6	Cons	1.22	•	Pa mill	Unknown/stat	Unknown/stat
143	LC	No	1620	1625	After 1300	Flood	•	0.06	•	•	No	•	80	>50%	Standby	Standby	Yes	•	•	•	•	•	•	5	2	200	6	Cons	•	6.10	Pa mill	Unknown/stat	Unknown/stat
144	LS	Yes	1201	1202	Before 1300	Flood	•	0.00	8	West	No	13	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	2	6	Cons	0.61	0.31	Pa mill	Unknown/stat	Unknown/stat
144	LS	Yes	1236	1240	Before 1300	Flood	•	0.00	8	West	No	13	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	4	2	100	9	Cove	7.62	6.10	Act mill	Unknown/stat	Unknown/stat
144	LS	Yes	1240	1243	Before 1300	Flood	•	0.00	8	West	No	13	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	3	2	100	9	Cove	9.14	12.19	Polar	East	East
144	LS	Yes	1111	1112	Before 1300	Flood	•	0.00	8	West	No	13	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	35	9	Cove	1.52	1.52	Act mill	Unknown/stat	Unknown/stat
144	LS	Yes	1226	1227	Before 1300	Flood	•	0.00	8	West	No	13	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	6	6	Cons	0.61	0.61	Polar	East	East
144	LS	Yes	1307	1317	After 1300	Flood	•	0.00	3	West	No	16	80	>50%	Standby	Standby	Yes	•	•	•	•	•	•	10	1	40	9	Cove	6.10	9.14	Polar	Unknown/stat	Unknown/stat
144	LS	Yes	1409	1410	After 1300	Flood	•	0.00	3	West	No	16	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	10	8	Cove	0.91	0.91	Act mill	South	East
144	LS	Yes	1346	1347	After 1300	Flood	•	0.00	3	West	No	16	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	60	3	Cons	0.61	1.22	Polar	East	East
144	LS	Yes	1425	1426	After 1300	Flood	•	0.00	8	West	No	16	60	>50%	None	Standby	Yes	•	•	•	•	•	•	1	1	2	9	Cove	0.31	0.61	Act mill	Unknown/stat	Unknown/stat
144	LS	Yes	1426	1427	After 1300	Flood	•	0.00	8	West	No	16	60	>50%	None	Standby	Yes	•	•	•	•	•	•	1	1	12	9	Cove	0.91	1.52	Act mill	Unknown/stat	Unknown/stat

J.D.	ID	Round	Start	Stop	AM/PM	T. Stg	Tide	Wave	Wd	—>	Rain	Air	Clds	Clds 2	DB State	60 State	Drive	DB Pile	60 Pile	DB Sh	60 Sh	DB -Z	60-Z	Obs'	#'s	Actual	Zone	Area	Depth	Shore	Behav	Behav Dir	Behav Dir 2
145	BF	Yes	841	845	Before 1300	Ebb	•	0.06	8	SE	No	10	70	>50%	None	None	No	•	•	•	•	•	•	4	1	15	9	Cove	6.10	9.14	Pa mill	Unknown/stat	Unknown/stat
145	BF	Yes	848	849	Before 1300	Ebb	•	0.06	8	SE	No	10	70	>50%	None	None	No	•	•	•	•	•	•	1	1	1	10	Cove	0.61	1.52	Polar	West	West
145	BF	Yes	825	830	Before 1300	Ebb	•	0.06	8	SE	No	10	90	>50%	None	None	No	•	•	•	•	•	•	5	1	25	5	Cons	0.91	3.05	Pa mill	Unknown/stat	Unknown/stat
145	LC	Yes	1525	1535	After 1300	Flood	•	0.06	•	•	No	18	80	>50%	None	None	No	•	•	•	•	•	•	10	1	25	3	Cons	1.22	0.91	Act mill	West	West
149	LS	Yes	1050	1051	Before 1300	Ebb	•	0.03	8	SE	No	14	100	>50%	None	Standby	No	•	•	•	•	•	•	1	1	3	9	Cove	0.61	0.91	Act mill	East	East
149	LS	Yes	951	953	Before 1300	Ebb	•	0.03	8	SE	No	14	100	>50%	None	Standby	No	•	•	•	•	•	•	2	1	10	6	Cons	0.91	0.91	Act mill	Unknown/stat	Unknown/stat
149	LS	Yes	1015	1019	Before 1300	Ebb	•	0.03	8	SE	No	14	100	>50%	None	Standby	No	•	•	•	•	•	•	4	1	12	9	Cove	3.05	4.57	Act mill	Unknown/stat	Unknown/stat
149	LS	Yes	852	853	Before 1300	Ebb	•	0.09	16	East	No	14	100	>50%	None	Standby	No	•	•	•	•	•	•	1	1	12	9	Cove	2.44	3.05	Act mill	Unknown/stat	Unknown/stat
149	LS	Yes	909	910	Before 1300	Ebb	•	0.09	16	East	No	14	100	>50%	None	Standby	No	•	•	•	•	•	•	1	1	15	5	Cons	0.61	1.52	Polar	Unknown/stat	Unknown/stat
149	LS	Yes	845	846	Before 1300	Ebb	•	0.09	16	East	No	14	100	>50%	None	Standby	No	•	•	•	•	•	•	1	1	3	9	Cove	0.61	0.91	Polar	East	East
149	LS	Yes	1151	1152	Before 1300	Ebb	•	0.03	24	SE	No	16	100	>50%	None	Standby	No	•	•	•	•	•	•	1	1	3	10	Cove	0.61	0.61	Act mill	Unknown/stat	Unknown/stat
149	LS	Yes	1438	1440	After 1300	Ebb	•	0.03	24	SE	No	16	80	>50%	None	Standby	No	•	•	•	•	•	•	2	1	12	9	Cove	0.61	0.61	Act mill	Unknown/stat	Unknown/stat
149	LS	Yes	1212	1213	Before 1300	Ebb	•	0.03	24	SE	No	16	100	>50%	None	Standby	No	•	•	•	•	•	•	1	1	8	14	Cove	0.31	0.61	•	Unknown/stat	Unknown/stat
149	LS	Yes	1447	1448	After 1300	Ebb	•	0.03	16	West	No	18	80	>50%	None	Standby	No	•	•	•	•	•	•	1	1	16	9	Cove	0.31	0.61	Act mill	West	West
150	BF	Yes	1316	1317	After 1300	Ebb	•	0.06	11	SW	No	18	0	<50%	Standby	•	Yes	600	•	•	•	•	•	1	1	1	5	Cons	2.44	0.91	Polar	East	East
150	BF	Yes	1320	1321	After 1300	Ebb	•	0.06	11	SW	No	18	0	<50%	Standby	•	Yes	700	•	•	•	•	•	1	1	2	2	Cons	0.61	1.52	Pa mill	Unknown/stat	Unknown/stat
150	BF	Yes	1207	1208	Before 1300	Ebb	•	0.00	16	SW	No	18	0	<50%	All	Standby	Yes	•	•	•	•	•	•	1	2	100	14	Cove	1.83	3.05	Polar	East	East
150	BF	Yes	1214	1215	Before 1300	Ebb	•	0.00	16	SW	No	18	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	1	11	Cove	0.31	1.22	Act mill	West	West
150	BF	Yes	1301	1303	After 1300	Ebb	•	0.06	16	West	No	18	0	<50%	Standby	•	Yes	500	•	•	•	•	•	2	1	2	5	Cons	0.91	1.83	Act mill	East	East
150	BF	Yes	1304	1312	After 1300	Ebb	•	0.06	16	West	No	18	0	<50%	Standby	•	Yes	500	•	•	•	•	•	8	1	25	5	Cons	1.22	3.05	Pa mill	Unknown/stat	Unknown/stat
150	BF	No	1228	1230	Before 1300	Ebb	•	0.06	16	West	No	18	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	2	1	50	9	Cove	2.13	3.05	Polar	East	East
150	BF	Yes	1217	1221	Before 1300	Ebb	•	0.06	16	West	No	18	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	4	1	7	11	Cove	0.31	0.61	Act mill	West	West
150	BF	Yes	1313	1315	After 1300	Ebb	•	0.06	16	West	No	18	0	<50%	Standby	•	Yes	500	•	•	•	•	•	2	1	12	5	Cons	1.22	3.05	Pa mill	Unknown/stat	Unknown/stat
150	LC	No	1521	1530	After 1300	Ebb	•	0.03	•	•	No	18	40	<50%	Standby	Standby	Yes	•	•	•	•	•	•	9	1	25	9	Cove	2.13	1.83	Pa mill	Unknown/stat	Unknown/stat
150	LC	Yes	1500	1501	After 1300	Ebb	•	0.03	•	•	No	18	30	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	1	4	Cons	0.91	1.83	Act mill	West	West
150	LC	Yes	1450	1451	After 1300	Ebb	•	0.03	•	•	No	18	30	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	1	5	Cons	0.61	0.91	Polar	East	East
150	LC	Yes	1435	1437	After 1300	Ebb	•	0.03	•	•	No	18	30	<50%	Standby	Standby	Yes	•	•	•	•	•	•	2	1	6	6	Cons	1.52	0.91	Polar	East	East
150	LC	Yes	1420	1421	After 1300	Ebb	•	0.03	•	•	No	18	30	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	4	11	Cove	0.91	1.22	Polar	East	East
150	LC	Yes	1415	1416	After 1300	Ebb	•	0.03	•	•	No	18	30	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	•	11	Cove	1.22	3.05	Polar	West	West
151	LS	Yes	1533	1534	After 1300	Ebb	•	0.03	8	West	No	13	100	>50%	Standby	Standby	Yes	250	•	•	•	•	•	1	1	3	5	Cons	0.31	0.91	Act mill	Unknown/stat	Unknown/stat
151	LS	Yes	1525	1526	After 1300	Ebb	•	0.09	16	West	No	13	100	>50%	All	Standby	Yes	200	•	•	•	•	•	1	1	9	5	Cons	0.61	2.13	Polar	East	East
151	LS	Yes	1149	1150	Before 1300	Ebb	•	0.00	24	South	Yes	13	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	1	9	Cove	0.31	0.31	Act mill	Unknown/stat	Unknown/stat
151	LS	Yes	1235	1236	Before 1300	Ebb	•	0.00	24	South	No	13	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	1	5	Cons	1.22	1.52	Act mill	Unknown/stat	Unknown/stat
151	LS	Yes	1046	1047	Before 1300	Flood	•	0.00	24	South	Yes	13	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	1	9	Cove	0.31	0.61	Act mill	West	West
151	LS	Yes	1336	1337	After 1300	Ebb	•	0.09	27	South	No	13	100	>50%	All	Standby	Yes	•	•	•	•	•	•	1	1	2	14	Cove	•	•	Act mill	Unknown/stat	Unknown/stat
151	LS	Yes	1400	1401	After 1300	Ebb	•	0.09	27	South	No	13	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	2	12	Cove	0.31	0.91	Act mill	Unknown/stat	Unknown/stat
151	LS	Yes	1342	1343	After 1300	Ebb	•	0.09	27	South	No	13	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	3	14	Cove	0.31	0.61	Polar	North	West
152	BF	Yes	933	934	Before 1300	Flood	•	0.06	11	SE	Yes	10	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	1	9	Cove	0.61	1.22	Pa mill	Unknown/stat	Unknown/stat
152	BF	Yes	955	956	Before 1300	Flood	•	0.06	11	SE	Yes	10	100	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	2	1	Cons	1.22	2.13	Pa mill	Unknown/stat	Unknown/stat
152	LC	Yes	1445	1450	After 1300	Ebb	•	0.03	•	•	No	•	100	>50%	All	Standby	Yes	•	•	•	•	•	•	5	1	8	9	Cove	3.05	10.67	Pa mill	Unknown/stat	Unknown/stat
155	KK	Yes	1450	1451	After 1300	Flood	•	0.30	27	SE	No	•	70	>50%	Standby	Standby	Yes	700	•	•	•	•	•	1	1	4	4	Cons	0.61	0.61	Polar	West	West
155	KK	Yes	1243	1245	Before 1300	Flood	•	0.30	27	SE	No	•	60	>50%	Standby	Standby	Yes	•	•	•	•	•	•	2	1	17	5	Cons	0.61	0.91	Pa mill	Unknown/stat	Unknown/stat
155	KK	Yes	1500	1502	After 1300	Flood	•	0.30	27	SE	No	•	70	>50%	Standby	Standby	Yes	650	•	•	•	•	•	2	1	20	5	Cons	0.61	0.91	Polar	West	West
155	KK	Yes	1448	1449	After 1300	Flood	•	0.30	27	SE	No	•	70	>50%	All	Standby	Yes	700	•	•	•	•	•	1	1	6	4	Cons	0.61	0.61	Polar	West	West
156	LS	Yes	841	842	Before 1300	Ebb	•	0.00	8	East	No	14	0	<50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	1	9	Cove	0.91	3.66	Act mill	Unknown/stat	Unknown/stat
156	LS	Yes	857	858	Before 1300	Ebb	•	0.00	8	East	No	14	0	<50%	Standby	Standby	Yes	250	•	•	•	•	•	1	1	7	6	Cons	0.31	0.31	Act mill	Unknown/stat	Unknown/stat
156	LS	Yes	903	904	Before 1300	Ebb	•	0.00	8	East	No	14	0	<50%	Standby	Standby	Yes	250	•	•	•	•	•	1	1	10	6	Cons	0.31	0.91	Act mill	East	East
156	LS	Yes	923	926	Before 1300	Ebb	•	0.00	8	West	No	14	30	<50%	Standby	Standby	Yes	•	•	•	•	•	•	3	1	3	3	Cons	0.31	0.31	Act mill	Unknown/stat	Unknown/stat
156	LS	Yes	944	945	Before 1300	Ebb	•	0.00	8	West	No	14	30	<50%	Standby	Standby	Yes	250	•	•	•	•	•	1	1	2	6	Cons	0.61	1.52	Act mill	Unknown/stat	Unknown/stat
156	LS	Yes	1128	1129	Before 1300	Flood	•	0.03	13	West	No	17	0	<50%	Standby	Standby	Yes	500	•	•	•	•	•	1	1	1	1	Cons	0.31	1.22	Polar	West	West
156	LS	Yes	1109	1110	Before 1300	Flood	•	0.03	13	West	No	17	20	<50%	Standby	Standby	Yes	250	•	•	•	•	•	1	1	10	6	Cons	0.31	0.91	Act mill	Unknown/stat	Unknown/stat
156	LS	Yes	1137	1138	Before 1300	Flood	•	0.00	8	West	No	17	40	<50%	All	Standby	Yes	250	•	•	•	•	•	1	1	2	5	Cons	0.31	0.91	Act mill	Unknown/stat	Unknown/stat

J.D.	ID	Round	Start	Stop	AM/PM	T. Stg	Tide	Wave	Wd	—>	Rain	Air	Clds	Clds 2	DB State	60 State	Drive	DB Pile	60 Pile	DB Sh	60 Sh	DB -Z	60-Z	Obs'	#'s	Actual	Zone	Area	Depth	Shore	Behav	Behav Dir	Behav Dir 2
156	LS	Yes	1322	1324	After 1300	Flood	•	0.00	8	West	No	17	10	<50%	Standby	Standby	Yes	•	•	•	•	•	•	2	1	2	9	Cove	0.31	0.61	Polar	Unknown/stat	Unknown/stat
156	LS	Yes	1254	1255	Before 1300	Flood	•	0.00	8	West	No	17	20	<50%	All	Standby	Yes	•	•	•	•	•	•	1	1	3	9	Cove	0.31	1.22	Act mill	Unknown/stat	Unknown/stat
158	KK	Yes	1444	1445	After 1300	Flood	•	0.30	24	South	No	•	90	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	1	11	Cove	0.61	0.91	Pa mill	Unknown/stat	Unknown/stat
158	KK	Yes	1211	1212	Before 1300	Flood	•	0.30	24	South	No	•	90	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	1	9	Cove	6.10	7.62	Pa mill	Unknown/stat	Unknown/stat
162	KK	Yes	1257	1300	Before 1300	Ebb	•	0.00	5	NE	No	•	100	>50%	Standby	Standby	Yes	800	•	•	•	•	•	3	1	4	8	Cove	3.05	3.05	Polar	South	East
162	KK	Yes	1030	1031	Before 1300	Ebb	•	0.00	5	NE	No	•	95	>50%	Standby	Standby	Yes	•	•	•	•	•	•	1	1	1	11	Cove	0.31	0.31	Polar	East	East
163	KK	Yes	1355	1356	After 1300	Ebb	•	0.00	0	•	No	•	100	>50%	All	Standby	Yes	680	•	•	•	•	•	1	1	1	5	Cons	0.31	1.52	Act mill	West	West
163	KK	Yes	1400	1401	After 1300	Ebb	•	0.00	0	•	No	•	100	>50%	All	Standby	Yes	700	•	•	•	•	•	1	1	1	5	Cons	0.31	1.52	Pa mill	Unknown/stat	Unknown/stat
164	KK	Yes	1202	1204	Before 1300	Ebb	•	0.00	0	•	No	•	80	>50%	Standby	Standby	Yes	•	•	•	•	•	•	2	1	3	4	Cons	0.31	0.61	Act mill	West	West

APPENDIX 1B: PILE DRIVING RIGS RAW DATA

J.D. .... Julian date
ID .... Observer: BF=Blake Feist, KK=Kevin Kumagai
Round .... Yes is ≥60 minutes spent on the rig, no is < 60 minutes spent on the rig
Start .... Time when observation of a given school was initiated
Stop .... Time when observation of a given school was terminated
AM/PM .... Time, classified as before or after 1300 hrs
T.Stg .... Tide stage classification as ebb or flood
Tide............... Tide elevation (m)
Wave .... Estimated wave height (m)
Wd .... Estimated wind velocity (km/h)
—> .... Estimated wind direction (north, east, west, or south)
Rain .... Yes or no
Clds .... Estimated cloud cover (%)
Clds 2 .... Estimated cloud cover as > or < 50%
DB State .... All is pile driving, none is total shutdown (non-pile driving days), standby is operational but not driving at the moment
60 State .... All is pile driving, none is total shutdown (non-pile driving days), standby is operational but not driving at the moment
Drive .... Yes is pile driving day, no is non-pile driving day
DB Pile .... Estimated school distance from DB pile being driven
60 Pile .... Estimated school distance from 60 pile being driven
Obs' .... Amount of time spent observing school (minutes)
#'s .... Estimated size of school (10's, 100's, or 1,000's)
Actual........... Estimated actual number of fish in school
Zone .... Which of the zones about the rig the school was sighted in
Zone 2 .... More generalized classification of zone school was observed in. Stern, side, or bow
Depth .... Estimated depth of water school was observed in (m)
Shore .... Estimated distance from shore school was observed in (m)
Behav .... Fish school behavior where Pa mill=passive mill, Act mill=active mill and Polar=polarized
Behav Dir .... Direction of movement (if any) of school (north, south, east, west. or stationary)
Behav Dir 2 .... Direction of movement (if any) of school (east, west. or unknown/stationary)
In Line? .... Yes=straight shot acoustically from the pile being driven to the school being observed
Grebes .... Estimate of number of western grebes within 300 m of the construction site
Other Act .... Other activity near the school being observed
Rig .... DB Pacific or The 60

J.D.	ID	Round	Start	Stop	AM/PM	T. Stg	Tide	Wave	Wd	—>	Rain	Clds	Clds 2	DB State	60 State	Drive	DB Pile	60 Pile	Obs'	#'s	Actual	Zone	Zone 2	Depth	Shore	Behav	Behav dir	Behav Dir 2	In line?	Grebes	Other Act	Rig
143	KK	Yes	753	830	Before 1300	Ebb	1.0	0.0	2	West	No	100	>50%	All	All	Yes	570	20	37	1	•	East 60	Side	11.582	114	Act mill	North	Towards	Yes	•	Movement	The 60
145	KK	Yes	800	802	Before 1300	Ebb	•	0.0	8	East	No	90	>50%	None	None	No	•	•	2	1	•	F90	Bow	•	480	Pa mill	Stat/unknown	Stationary	No	1	•	DB Pac
145	KK	Yes	804	805	Before 1300	Ebb	•	0.0	8	East	No	90	>50%	None	None	No	•	•	1	1	•	NW	Side	•	480	Polar	South	Away	No	•	•	DB Pac
109	KK	Yes	815	816	Before 1300	Flood	•	•	8	East	Yes	100	>50%	None	None	No	•	•	1	1	•	B60	Stern	4.267	43	Act mill	East	Lateral	No	•	•	The 60
145	KK	No	820	821	Before 1300	Ebb	•	0.0	8	East	No	90	>50%	None	None	No	•	•	1	1	•	F90	Bow	•	480	Pa mill	Stat/unknown	Stationary	No	•	•	DB Pac
136	KK	Yes	820	925	Before 1300	Flood	2.3	0.0	8	East	No	60	>50%	All	All	Yes	100	500	65	2	100	NW	Side	•	400	Polar	South	Away	Yes	•	Movement	DB Pac
141	KK	Yes	827	840	Before 1300	Ebb	0.3	0.1	8	East	No	60	>50%	Standby	All	Yes	410	130	27	1	•	B60	Stern	13.411	119	Act mill	West	Lateral	No	2	•	The 60
109	KK	Yes	830	831	Before 1300	Flood	•	•	8	East	Yes	100	>50%	None	None	No	•	•	1	1	•	East 60	Side	4.267	43	Polar	South	Away	No	•	•	The 60
145	KK	Yes	831	841	Before 1300	Ebb	•	0.0	8	East	No	90	>50%	None	None	No	•	•	10	1	•	NW	Side	•	480	Polar	North	Towards	No	2	Movement	DB Pac
128	BF	Yes	837	839	Before 1300	Ebb	0.8	0.0	8	NE	No	0	<50%	Standby	Standby	Yes	80	390	2	1	12	NW	Side	•	260	Polar	North	Towards	No	•	•	DB Pac
121	KK	No	839	844	Before 1300	Flood	2.3	0.0	8	East	No	100	>50%	All	Standby	Yes	30	•	5	2	•	F90	Bow	•	320	Act mill	North	Towards	Yes	•	•	DB Pac
124	KK	Yes	840	843	Before 1300	Ebb	•	0.0	8	West	No	0	<50%	None	Standby	No	•	•	3	1	6	B90	Stern	•	260	Act mill	South	Away	No	•	•	DB Pac
166	KK	Yes	840	841	Before 1300	Flood	2.2	0.0	8	West	No	100	>50%	Standby	Standby	Yes	60	•	1	1	2	F90	Bow	•	680	Act mill	West	Lateral	No	•	•	DB Pac
124	KK	Yes	844	845	Before 1300	Flood	•	0.0	8	West	No	0	<50%	None	Standby	No	•	•	1	1	•	B90	Stern	•	260	Pa mill	Stat/unknown	Stationary	No	•	•	DB Pac
124	KK	Yes	847	848	Before 1300	Flood	•	0.0	8	West	No	0	<50%	None	Standby	No	•	•	1	1	•	SW	Side	•	260	Polar	South	Away	No	•	Shade	DB Pac
124	KK	Yes	850	853	Before 1300	Flood	•	0.0	8	West	No	0	<50%	None	Standby	No	•	•	3	1	•	SW	Side	•	260	Polar	South	Away	No	•	•	DB Pac
131	KK	Yes	853	956	Before 1300	Ebb	•	0.1	8	SE	No	100	>50%	None	None	No	•	•	13	1	10	F90	Bow	•	500	Act mill	North	Towards	No	•	•	DB Pac
124	KK	Yes	855	857	Before 1300	Flood	•	0.0	8	West	No	0	<50%	None	Standby	No	•	•	2	1	•	NW	Side	•	260	Polar	South	Away	No	•	Shade	DB Pac
128	BF	Yes	856	902	Before 1300	Ebb	0.8	0.0	8	NE	No	0	<50%	All	Standby	Yes	150	400	6	1	11	SW	Side	•	260	Act mill	North	Towards	No	•	•	DB Pac
145	KK	Yes	858	859	Before 1300	Ebb	•	0.0	8	East	No	90	>50%	None	None	No	•	•	1	1	•	NW	Side	•	480	Polar	North	Towards	No	•	•	DB Pac
124	KK	No	859	900	Before 1300	Flood	•	0.0	8	West	No	0	<50%	None	Standby	No	•	•	1	1	•	NW	Side	•	260	Polar	South	Away	No	•	•	DB Pac
143	KK	Yes	859	900	Before 1300	Ebb	-0.1	0.0	2	West	No	100	>50%	Standby	Standby	Yes	590	130	1	1	4	East 60	Side	12.192	119	Act mill	South	Away	No	•	•	The 60
124	KK	No	901	902	Before 1300	Flood	•	0.0	8	West	No	0	<50%	None	Standby	No	•	•	1	2	•	F90	Bow	•	•	Act mill	North	Towards	No	•	•	DB Pac
149	KK	Yes	902	906	Before 1300	Ebb	•	0.0	5	SE	No	90	>50%	None	Standby	No	•	•	4	1	•	F90	Bow	•	480	Act mill	West	Lateral	No	•	•	DB Pac
121	KK	Yes	903	920	Before 1300	Flood	2.4	0.0	8	East	No	100	>50%	All	Standby	Yes	25	•	17	2	•	F90	Bow	•	320	Act mill	North	Towards	Yes	200	•	DB Pac
128	BF	No	903	906	Before 1300	Ebb	0.6	0.0	8	NE	No	0	<50%	Standby	Standby	Yes	70	390	3	1	11	NW	Side	•	260	Act mill	South	Away	No	•	•	DB Pac
134	KK	Yes	905	906	Before 1300	Ebb	•	0.0	5	South	Yes	100	>50%	Standby	Standby	No	•	•	1	1	1	B60	Stern	9.449	88	Polar	South	Away	No	•	•	The 60
124	KK	Yes	906	907	Before 1300	Flood	•	0.0	8	West	No	0	<50%	None	Standby	No	•	•	1	2	•	F90	Bow	•	•	Act mill	East	Lateral	No	•	Shade	DB Pac
124	KK	No	909	910	Before 1300	Flood	•	0.0	8	West	No	0	<50%	None	Standby	No	•	•	1	1	•	NW	Side	•	260	Act mill	South	Away	No	•	Shade	DB Pac
149	KK	Yes	914	915	Before 1300	Ebb	•	0.0	5	SE	No	90	>50%	None	Standby	No	•	•	1	1	•	B90	Stern	•	480	Pa mill	Stat/unknown	Stationary	No	•	•	DB Pac
156	KK	Yes	918	919	Before 1300	Ebb	•	0.0	8	West	No	10	<50%	Standby	Standby	Yes	200	•	1	1	1	NW	Side	•	620	Polar	North	Towards	No	2	Shade	DB Pac
141	KK	Yes	918	925	Before 1300	Flood	0.2	0.1	8	East	No	30	<50%	Standby	All	Yes	420	10	7	1	•	F60	Bow	12.192	108	Act mill	North	Towards	No	•	Shade	The 60
120	KK	Yes	918	919	Before 1300	Ebb	•	0.2	11	East	No	0	<50%	Standby	Standby	Yes	•	•	1	1	•	F60	Bow	14.935	59	Act mill	East	Lateral	No	•	•	The 60
114	KK	Yes	919	921	Before 1300	Ebb	•	0.0	0	•	No	100	>50%	None	None	No	•	•	2	1	25	B90	Stern	•	280	Act mill	South	Away	No	•	•	DB Pac
150	KK	Yes	919	1038	Before 1300	Flood	•	0.0	8	East	No	10	<50%	Standby	Standby	Yes	•	•	79	1	•	F90	Bow	•	560	Pa mill	Stat/unknown	Stationary	No	•	•	DB Pac
143	KK	Yes	920	1145	Before 1300	Ebb	-0.1	0.0	8	West	No	100	>50%	All	All	Yes	590	20	145	1	•	East 60	Side	11.582	119	Act mill	North	Towards	Yes	•	Movement	The 60
120	KK	Yes	921	930	Before 1300	Ebb	•	0.2	11	East	No	0	<50%	Standby	Standby	Yes	•	•	9	2	•	East 60	Side	14.935	59	Polar	East	Lateral	No	•	•	The 60
138	KK	Yes	925	930	Before 1300	Flood	1.7	0.0	5	South	No	100	>50%	Standby	Standby	Yes	80	430	5	1	•	F90	Bow	•	440	Pa mill	Stat/unknown	Stationary	No	•	•	DB Pac
129	KK	Yes	926	1008	Before 1300	Ebb	0.4	0.0	5	West	No	0	<50%	All	Standby	Yes	1	500	42	2	•	F90	Bow	•	380	Polar	South	Away	Yes	•	Shade	DB Pac
138	KK	Yes	927	928	Before 1300	Flood	1.7	0.0	5	South	No	100	>50%	Standby	Standby	Yes	40	460	1	2	•	NW	Side	•	440	Act mill	East	Lateral	No	•	•	DB Pac
142	KK	Yes	930	940	Before 1300	Ebb	-0.3	0.0	3	SE	No	70	>50%	All	Standby	Yes	15	590	10	1	7	NW	Side	•	500	Act mill	South	Away	Yes	1	•	DB Pac
150	KK	Yes	931	1049	Before 1300	Flood	•	0.0	8	East	No	10	<50%	Standby	Standby	Yes	•	•	78	1	•	B90	Stern	•	560	Act mill	South	Away	No	•	•	DB Pac
122	KK	No	933	934	Before 1300	Flood	1.9	0.0	0	•	Yes	100	>50%	All	Standby	Yes	60	•	1	1	•	F90	Bow	•	340	Pa mill	Stat/unknown	Stationary	No	•	•	DB Pac
114	KK	Yes	935	937	Before 1300	Ebb	•	0.0	0	•	No	100	>50%	None	None	No	•	•	2	1	50	F90	Bow	•	280	Act mill	West	Lateral	No	•	•	DB Pac
122	KK	No	936	941	Before 1300	Flood	1.9	0.0	0	•	No	100	>50%	All	Standby	Yes	15	•	5	1	•	NW	Side	•	340	Act mill	South	Away	Yes	•	•	DB Pac
138	KK	No	937	940	Before 1300	Flood	1.7	0.0	5	South	No	100	>50%	Standby	Standby	Yes	40	460	3	1	•	NW	Side	•	440	Act mill	North	Towards	No	•	•	DB Pac
152	KK	Yes	940	941	Before 1300	Flood	1.5	0.3	16	East	Yes	100	>50%	All	Standby	Yes	60	•	1	1	1	NW	Side	•	500	Polar	West	Lateral	No	•	•	DB Pac
138	KK	No	944	1000	Before 1300	Flood	1.8	0.1	8	South	No	100	>50%	All	All	Yes	30	460	16	2	•	NW	Side	•	440	Act mill	North	Towards	Yes	•	•	DB Pac
122	KK	Yes	945	947	Before 1300	Flood	1.9	0.0	0	•	Yes	100	>50%	Standby	Standby	Yes	60	•	2	1	•	F90	Bow	•	340	Act mill	West	Lateral	No	•	•	DB Pac
128	BF	No	946	949	Before 1300	Ebb	0.2	0.0	0	•	No	0	<50%	All	All	Yes	400	100	3	1	30	East 60	Side	6.706	81	Polar	South	Away	No	•	•	The 60
95	BF	Yes	947	951	Before 1300	Flood	•	0.0	0	•	No	0	<50%	None	None	No	•	•	4	3	•	F90	Bow	•	180	Pa mill	Stat/unknown	Stationary	No	•	Shade	DB Pac
135	KK	No	950	951	Before 1300	Ebb	2.2	0.0	5	SE	No	100	>50%	Standby	Standby	Yes	410	130	1	1	1	East 60	Side	10.668	88	Polar	East	Lateral	No	•	•	The 60
128	BF	Yes	950	954	Before 1300	Ebb	0.2	0.0	0	•	No	0	<50%	All	Standby	Yes	420	130	4	1	30	B60	Stern	6.706	81	Pa mill	Stat/unknown	Stationary	No	•	•	The 60

J.D.	ID	Round	Start	Stop	AM/PM	T. Stg	Tide	Wave	Wd	—>	Rain	Clds	Clds 2	DB State	60 State	Drive	DB Pile	60 Pile	Obs'	#'s	Actual	Zone	Zone 2	Depth	Shore	Behav	Behav dir	Behav Dir 2	In line?	Grebes	Other Act	Rig
127	KK	Yes	950	951	Before 1300	Ebb	•	0.2	16	South	Yes	100	>50%	Standby	Standby	No	•	•	1	1	•	B90	Stern	•	260	Polar	South	Away	No	4	•	DB Pac
95	BF	Yes	952	953	Before 1300	Flood	•	0.0	0	•	No	0	<50%	None	None	No	•	•	1	2	200	B90	Stern	•	180	Polar	North	Towards	No	•	•	DB Pac
95	BF	Yes	953	956	Before 1300	Flood	•	0.0	0	•	No	0	<50%	None	None	No	•	•	3	2	•	B90	Stern	•	180	Act mill	North	Towards	No	•	•	DB Pac
120	KK	No	955	957	Before 1300	Ebb	•	0.2	11	East	No	0	<50%	Standby	Standby	Yes	•	•	2	2	•	F60	Bow	14.935	59	Act mill	West	Lateral	No	•	•	The 60
152	KK	Yes	957	958	Before 1300	Flood	1.6	0.3	16	East	Yes	100	>50%	Standby	Standby	Yes	200	•	1	1	6	B90	Stern	•	500	Polar	East	Lateral	No	•	•	DB Pac
142	KK	Yes	958	1002	Before 1300	Flood	-0.4	0.0	3	SE	No	70	>50%	Standby	Standby	Yes	250	830	4	2	•	B90	Stern	•	500	Act mill	South	Away	No	•	•	DB Pac
128	BF	No	1004	1005	Before 1300	Ebb	0.2	0.0	0	•	No	0	<50%	Standby	Standby	Yes	380	100	1	1	30	East 60	Side	6.706	81	Polar	East	Lateral	No	•	•	The 60
122	KK	No	1006	1036	Before 1300	Flood	2.0	0.0	0	•	No	100	>50%	All	Standby	Yes	80	•	30	1	•	F90	Bow	•	340	Act mill	West	Lateral	No	•	•	DB Pac
117	KK	No	1009	1010	Before 1300	Ebb	1.2	0.0	8	East	Yes	100	>50%	Standby	Standby	Yes	75	310	1	2	•	NW	Side	•	300	Act mill	South	Away	No	•	•	DB Pac
120	KK	No	1010	1013	Before 1300	Ebb	•	0.0	0	•	No	0	<50%	Standby	Standby	Yes	•	•	3	3	•	F90	Bow	•	220	Act mill	South	Away	No	•	•	DB Pac
120	KK	No	1010	1033	Before 1300	Ebb	•	0.0	0	•	No	0	<50%	Standby	Standby	Yes	•	•	23	3	•	F90	Bow	•	220	Act mill	East	Lateral	No	•	Boat	DB Pac
142	KK	Yes	1014	1016	Before 1300	Flood	-0.3	0.0	3	SE	No	60	>50%	All	Standby	Yes	100	630	2	1	•	F90	Bow	•	500	Polar	West	Lateral	No	•	•	DB Pac
117	KK	No	1014	1022	Before 1300	Ebb	1.2	0.0	8	East	Yes	100	>50%	Standby	Standby	Yes	75	310	8	2	•	NW	Side	•	300	Act mill	West	Lateral	Yes	•	Shade	DB Pac
128	BF	Yes	1015	1017	Before 1300	Ebb	0.1	0.0	0	•	No	0	<50%	Standby	Standby	Yes	400	130	2	1	4	B60	Stern	4.877	74	Polar	East	Lateral	No	•	•	The 60
134	KK	Yes	1017	1018	Before 1300	Ebb	•	0.0	5	South	No	100	>50%	Standby	Standby	No	•	•	1	1	1	F60	Bow	9.449	88	Pa mill	Stat/unknown	Stationary	No	•	•	The 60
149	KK	Yes	1018	1019	Before 1300	Ebb	•	0.0	5	SE	No	90	>50%	None	Standby	No	•	•	1	1	2	F90	Bow	•	480	Polar	South	Away	No	•	•	DB Pac
102	BF	Yes	1020	1023	Before 1300	Ebb	•	0.0	•	•	No	90	>50%	None	None	No	•	•	3	3	1500	F90	Bow	•	220	Pa mill	Stat/unknown	Stationary	No	•	•	DB Pac
128	BF	Yes	1020	1030	Before 1300	Ebb	0.1	0.0	3	West	No	0	<50%	All	All	Yes	460	20	10	1	•	East 60	Side	4.877	74	Act mill	South	Away	Yes	•	•	The 60
120	KK	Yes	1022	1024	Before 1300	Ebb	•	0.0	0	•	No	0	<50%	Standby	Standby	Yes	•	•	2	1	•	B90	Stern	•	220	Act mill	North	Towards	No	•	•	DB Pac
149	KK	No	1022	1023	Before 1300	Ebb	•	0.0	5	SE	No	90	>50%	None	Standby	No	•	•	1	1	•	F90	Bow	•	480	Polar	South	Away	No	•	•	DB Pac
117	KK	No	1022	1029	Before 1300	Ebb	1.2	0.0	8	East	Yes	100	>50%	Standby	All	Yes	75	300	7	2	•	F90	Bow	•	300	Act mill	East	Lateral	No	•	•	DB Pac
121	BF	Yes	1023	1024	Before 1300	Ebb	2.4	0.1	3	East	No	100	>50%	All	Standby	Yes	200	•	1	2	•	B90	Stern	•	320	Pa mill	Stat/unknown	Stationary	No	•	•	DB Pac
143	KK	Yes	1023	1024	Before 1300	Ebb	-0.7	0.0	8	West	No	100	>50%	All	Standby	Yes	580	130	1	1	•	East 60	Side	11.278	119	Act mill	North	Towards	No	•	•	The 60
131	KK	No	1028	1029	Before 1300	Ebb	•	0.1	8	SE	No	100	>50%	None	None	No	•	•	1	1	•	F90	Bow	•	500	Polar	North	Towards	No	6	•	DB Pac
149	KK	Yes	1029	1030	Before 1300	Ebb	•	0.0	11	SE	No	90	>50%	None	Standby	No	•	•	1	1	5	NW	Side	•	480	Polar	North	Towards	No	•	•	DB Pac
127	KK	Yes	1030	1031	Before 1300	Ebb	•	0.2	16	South	Yes	100	>50%	Standby	Standby	No	•	•	1	1	•	F90	Bow	•	260	Polar	North	Towards	No	•	Misc	DB Pac
120	KK	No	1031	1033	Before 1300	Ebb	•	0.0	0	•	No	0	<50%	Standby	Standby	Yes	•	•	2	3	•	F90	Bow	•	220	Act mill	North	Towards	No	•	•	DB Pac
117	KK	Yes	1034	1035	Before 1300	Ebb	1.1	0.0	8	East	Yes	100	>50%	Standby	All	Yes	200	470	1	1	•	B90	Stern	•	300	Act mill	North	Towards	No	•	•	DB Pac
127	KK	Yes	1035	1036	Before 1300	Ebb	•	0.2	16	South	Yes	100	>50%	Standby	Standby	No	•	•	1	1	•	F90	Bow	•	260	Polar	East	Lateral	No	•	•	DB Pac
102	BF	Yes	1036	1037	Before 1300	Ebb	•	0.0	•	•	No	•	•	None	None	No	•	•	1	1	•	SW	Side	•	220	Polar	North	Towards	No	•	•	DB Pac
120	KK	Yes	1036	1037	Before 1300	Ebb	•	0.0	0	•	No	0	<50%	Standby	Standby	Yes	•	•	1	1	•	SW	Side	•	220	Polar	South	Away	No	•	Shade	DB Pac
129	KK	Yes	1036	1050	Before 1300	Ebb	-0.1	0.0	5	West	No	0	<50%	All	All	Yes	35	640	14	2	•	F90	Bow	•	380	Act mill	West	Lateral	Yes	•	Boat	DB Pac
108	BF	Yes	1037	1038	Before 1300	Ebb	2.4	0.0	•	•	No	•	•	All	Standby	Yes	590	70	1	2	100	F60	Bow	7.01	43	Pa mill	Stat/unknown	Stationary	No	•	•	The 60
117	KK	Yes	1038	1052	Before 1300	Ebb	0.9	0.0	8	East	Yes	100	>50%	Standby	Standby	Yes	75	300	14	2	•	F90	Bow	•	300	Pa mill	Stat/unknown	Stationary	No	•	•	DB Pac
120	KK	No	1039	1040	Before 1300	Ebb	•	0.0	0	•	No	0	<50%	Standby	Standby	Yes	•	•	1	1	•	B90	Stern	•	220	Act mill	South	Away	No	•	•	DB Pac
138	KK	No	1044	1055	Before 1300	Flood	2.0	0.1	8	South	No	100	>50%	All	All	Yes	60	410	11	2	•	F90	Bow	•	380	Pa mill	Stat/unknown	Stationary	Yes	•	•	DB Pac
134	KK	Yes	1044	1049	Before 1300	Ebb	•	0.0	5	South	No	100	>50%	Standby	Standby	No	•	•	5	1	30	F90	Bow	•	500	Pa mill	Stat/unknown	Stationary	No	2	•	DB Pac
149	KK	Yes	1045	1046	Before 1300	Ebb	•	0.0	11	SE	No	90	>50%	None	Standby	No	•	•	1	1	•	F90	Bow	•	480	Polar	South	Away	No	•	•	DB Pac
120	KK	Yes	1045	1046	Before 1300	Ebb	•	0.0	0	•	No	0	<50%	Standby	Standby	Yes	•	•	1	3	•	F90	Bow	•	220	Act mill	South	Away	No	•	•	DB Pac
102	BF	Yes	1050	1051	Before 1300	Ebb	•	0.0	•	•	No	90	>50%	None	None	No	•	•	1	2	100	B90	Stern	•	220	Polar	East	Lateral	No	•	•	DB Pac
117	KK	No	1053	1058	Before 1300	Ebb	0.8	0.0	8	East	Yes	100	>50%	All	Standby	Yes	75	300	5	2	•	F90	Bow	•	300	Pa mill	Stat/unknown	Stationary	No	•	•	DB Pac
135	KK	Yes	1053	1059	Before 1300	Ebb	1.7	0.1	8	West	No	100	>50%	Standby	All	Yes	200	620	6	1	•	B90	Stern	•	400	Act mill	North	Towards	No	1	•	DB Pac
136	KK	Yes	1054	1103	Before 1300	Ebb	2.0	0.0	3	SW	No	30	<50%	Standby	Standby	Yes	530	•	9	1	•	B60	Stern	10.668	95	Polar	East	Lateral	No	•	•	The 60
127	KK	Yes	1055	1102	Before 1300	Flood	•	0.2	16	South	Yes	100	>50%	Standby	Standby	No	•	•	7	1	•	F60	Bow	6.096	74	Polar	East	Lateral	No	•	Boat	The 60
121	BF	Yes	1055	1123	Before 1300	Ebb	2.3	0.1	3	East	No	100	>50%	All	Standby	Yes	220	550	28	2	•	SW	Side	•	320	Act mill	North	Towards	No	1	•	DB Pac
142	KK	Yes	1055	1100	Before 1300	Flood	0.1	0.1	8	South	No	70	>50%	Standby	Standby	Yes	610	25	5	1	•	East 60	Side	10.363	102	Act mill	North	Towards	No	•	•	The 60
128	KK	Yes	1056	1100	Before 1300	Ebb	-0.1	0.0	3	West	No	0	<50%	All	All	Yes	40	490	4	1	•	NW	Side	•	280	Act mill	North	Towards	Yes	•	Shade	DB Pac
108	BF	Yes	1057	1058	Before 1300	Ebb	2.4	0.0	•	•	No	•	•	Standby	Standby	Yes	560	•	1	2	•	B60	Stern	7.01	43	Act mill	North	Towards	No	•	•	The 60
120	KK	Yes	1057	1107	Before 1300	Ebb	2.1	0.0	0	•	No	0	<50%	Standby	Standby	Yes	•	•	10	2	•	East 60	Side	14.935	59	Polar	South	Away	No	•	•	The 60
129	KK	Yes	1059	1103	Before 1300	Ebb	-0.3	0.0	5	West	No	0	<50%	All	Standby	Yes	60	640	4	1	3	NW	Side	•	380	Act mill	South	Away	No	•	•	DB Pac
117	KK	No	1102	1105	Before 1300	Ebb	0.8	0.0	8	East	Yes	100	>50%	All	Standby	Yes	35	300	3	2	•	F90	Bow	•	300	Act mill	West	Lateral	No	•	•	DB Pac
150	KK	Yes	1103	1110	Before 1300	Flood	2.3	0.0	8	East	No	5	<50%	All	Standby	Yes	30	•	7	1	•	F90	Bow	•	560	Polar	North	Towards	Yes	•	Boat	DB Pac
117	KK	No	1106	1120	Before 1300	Ebb	-0.2	0.0	8	East	Yes	100	>50%	All	All	Yes	35	300	14	2	•	F90	Bow	•	300	Act mill	East	Lateral	No	•	•	DB Pac

J.D.	ID	Round	Start	Stop	AM/PM	T. Stg	Tide	Wave	Wd	—>	Rain	Clds	Clds 2	DB State	60 State	Drive	DB Pile	60 Pile	Obs'	#'s	Actual	Zone	Zone 2	Depth	Shore	Behav	Behav dir	Behav Dir 2	In line?	Grebes	Other Act	Rig
131	KK	Yes	1110	1112	Before 1300	Ebb	•	0.1	8	SE	No	100	>50%	None	None	No	•	•	2	1	•	F90	Bow	•	500	Pa mill	Stat/unknown	Stationary	No	•	•	DB Pac
120	KK	No	1110	1113	Before 1300	Ebb	2.1	0.0	0	•	No	0	<50%	Standby	All	Yes	400	40	3	2	•	F60	Bow	14.935	59	Polar	South	Away	Yes	•	•	The 60
129	KK	No	1111	1121	Before 1300	Flood	-0.3	0.0	5	West	No	0	<50%	Standby	Standby	Yes	60	590	10	2	•	NW	Side	•	380	Polar	West	Lateral	No	•	•	DB Pac
108	BF	No	1111	1127	Before 1300	Ebb	2.3	0.0	•	•	No	•	•	All	All	Yes	470	130	16	2	•	B60	Stern	7.01	43	Act mill	North	Towards	No	•	•	The 60
141	KK	Yes	1114	1120	Before 1300	Flood	0.8	0.0	3	West	No	10	<50%	Standby	All	Yes	520	15	6	1	3	East 60	Side	12.802	114	Act mill	South	Away	No	•	•	The 60
120	KK	Yes	1118	1120	Before 1300	Ebb	2.0	0.0	0	•	No	0	<50%	Standby	Standby	Yes	370	130	2	2	•	B60	Stern	14.935	59	Act mill	North	Towards	No	•	•	The 60
123	KK	Yes	1119	1241	Before 1300	Flood	1.9	0.2	16	West	No	0	<50%	Standby	All	Yes	•	130	82	1	•	B60	Stern	8.534	81	Pa mill	Stat/unknown	Stationary	No	•	•	The 60
137	KK	Yes	1120	1125	Before 1300	Ebb	2.0	0.0	2	SE	No	100	>50%	All	Standby	Yes	330	30	5	1	1	East 60	Side	10.668	114	Polar	East	Lateral	No	•	•	The 60
135	KK	No	1121	1125	Before 1300	Ebb	1.5	0.1	8	West	No	100	>50%	Standby	Standby	Yes	200	620	4	1	•	B90	Stern	•	400	Act mill	North	Towards	No	•	•	DB Pac
128	KK	Yes	1122	1123	Before 1300	Ebb	-0.1	0.0	3	West	No	0	<50%	Standby	Standby	Yes	100	520	1	1	•	NW	Side	•	280	Polar	North	Towards	No	•	•	DB Pac
120	KK	No	1123	1134	Before 1300	Ebb	2.0	0.0	0	•	No	0	<50%	All	Standby	Yes	40	420	11	2	•	F90	Bow	•	220	Act mill	South	Away	Yes	•	•	DB Pac
123	KK	Yes	1124	1132	Before 1300	Flood	1.9	0.2	16	West	No	0	<50%	Standby	All	Yes	•	40	8	1	•	East 60	Side	8.534	81	Act mill	South	Away	Yes	•	Movement	The 60
131	KK	No	1125	1130	Before 1300	Ebb	•	0.1	8	SE	No	100	>50%	None	None	No	•	•	5	1	30	F90	Bow	•	500	Pa mill	Stat/unknown	Stationary	No	•	•	DB Pac
135	KK	Yes	1125	1135	Before 1300	Ebb	1.4	0.1	8	West	No	100	>50%	Standby	Standby	Yes	200	620	10	1	•	B90	Stern	•	400	Act mill	West	Lateral	No	4	•	DB Pac
134	KK	No	1128	1132	Before 1300	Ebb	•	0.0	5	South	No	100	>50%	Standby	Standby	No	•	•	4	1	30	F90	Bow	•	500	Pa mill	Stat/unknown	Stationary	No	3	•	DB Pac
114	KK	Yes	1128	1132	Before 1300	Flood	•	0.0	-3	East	No	100	>50%	None	None	No	•	•	4	1	50	F60	Bow	5.486	51	Polar	West	Lateral	No	•	•	The 60
130	KK	Yes	1130	1135	Before 1300	Ebb	-0.3	0.0	2	West	No	100	>50%	All	Standby	Yes	300	130	5	1	•	B60	Stern	7.01	88	Act mill	West	Lateral	No	•	•	The 60
158	KK	Yes	1130	1131	Before 1300	Flood	-0.2	0.3	24	South	No	90	>50%	Standby	Standby	Yes	50	•	1	1	1	F90	Bow	•	660	Polar	West	Lateral	Yes	•	•	DB Pac
128	KK	Yes	1131	1139	Before 1300	Flood	0.1	0.0	3	West	No	0	<50%	All	All	Yes	490	8	8	1	•	East 60	Side	5.182	74	Act mill	North	Towards	Yes	1	•	The 60
137	KK	Yes	1132	1136	Before 1300	Ebb	2.0	0.0	2	SE	No	100	>50%	Standby	Standby	Yes	280	130	4	1	•	B60	Stern	10.668	114	Act mill	North	Towards	No	•	Movement	The 60
150	KK	Yes	1134	1135	Before 1300	Ebb	2.3	0.0	8	East	No	5	<50%	All	Standby	Yes	60	•	1	1	•	F90	Bow	•	560	Act mill	East	Lateral	Yes	•	Shade	DB Pac
136	KK	Yes	1135	1137	Before 1300	Ebb	•	0.0	3	SW	No	30	<50%	Standby	Standby	Yes	180	•	2	1	•	B60	Stern	10.668	102	Act mill	South	Away	No	•	•	The 60
149	KK	Yes	1135	1140	Before 1300	Ebb	•	0.0	11	SE	No	80	>50%	None	Standby	No	•	•	5	1	•	East 60	Side	•	130	Act mill	North	Towards	No	•	•	The 60
130	KK	Yes	1136	1137	Before 1300	Ebb	-0.3	0.0	2	West	No	100	>50%	All	Standby	Yes	300	130	1	1	6	B60	Stern	7.01	88	Act mill	West	Lateral	No	•	•	The 60
114	KK	Yes	1137	1157	Before 1300	Flood	•	0.0	3	East	No	100	>50%	None	None	No	•	•	20	3	1000	B60	Stern	5.486	51	Act mill	East	Lateral	No	3	•	The 60
120	KK	Yes	1140	1146	Before 1300	Ebb	1.8	0.0	0	•	No	0	<50%	All	All	Yes	200	520	6	1	•	B90	Stern	•	220	Act mill	South	Away	No	•	•	DB Pac
151	KK	Yes	1141	1142	Before 1300	Ebb	2.4	0.1	19	SE	Yes	100	>50%	Standby	Standby	Yes	40	•	1	1	•	F90	Bow	•	580	Polar	East	Lateral	No	•	•	DB Pac
141	KK	Yes	1141	1143	Before 1300	Flood	1.1	0.0	3	West	No	10	<50%	All	All	Yes	460	130	2	1	•	B60	Stern	12.802	119	Act mill	West	Lateral	No	•	•	The 60
108	BF	Yes	1144	1145	Before 1300	Ebb	2.1	•	•	•	No	•	•	Standby	Standby	Yes	80	610	1	2	•	F90	Bow	•	260	Act mill	East	Lateral	No	•	•	DB Pac
131	KK	Yes	1146	1152	Before 1300	Ebb	•	0.1	16	South	No	100	>50%	None	None	No	•	•	6	1	•	East 60	Side	9.449	88	Act mill	North	Towards	No	3	•	The 60
129	KK	Yes	1146	1157	Before 1300	Flood	-0.3	0.0	5	West	No	0	<50%	All	Standby	Yes	600	130	11	2	•	B60	Stern	5.182	81	Act mill	North	Towards	No	•	•	The 60
108	BF	Yes	1148	1149	Before 1300	Ebb	2.1	•	•	•	No	•	•	Standby	Standby	Yes	200	690	1	1	•	B90	Stern	•	260	Pa mill	Stat/unknown	Stationary	No	•	•	DB Pac
134	KK	Yes	1150	1153	Before 1300	Ebb	•	0.0	5	South	No	100	>50%	Standby	Standby	No	•	•	3	1	•	F90	Bow	•	500	Polar	North	Towards	No	•	•	DB Pac
144	KK	Yes	1150	1153	Before 1300	Flood	-0.9	0.0	2	West	No	95	>50%	All	Standby	Yes	20	•	3	1	12	F90	Bow	•	480	Act mill	East	Lateral	Yes	•	•	DB Pac
138	KK	Yes	1154	1158	Before 1300	Ebb	2.1	0.0	3	SW	No	95	>50%	Standby	All	Yes	290	130	4	1	•	East 60	Side	10.668	102	Act mill	West	Lateral	No	•	•	The 60
120	KK	No	1155	1156	Before 1300	Ebb	1.6	0.0	0	•	No	0	<50%	Standby	Standby	Yes	200	520	1	1	•	B90	Stern	•	220	Act mill	South	Away	No	•	•	DB Pac
151	KK	Yes	1157	1158	Before 1300	Ebb	2.4	0.1	19	SE	Yes	100	>50%	All	Standby	Yes	200	•	1	1	•	B90	Stern	•	580	Polar	South	Away	No	•	•	DB Pac
120	KK	Yes	1159	1200	Before 1300	Ebb	1.6	0.0	0	•	No	0	<50%	Standby	Standby	Yes	40	420	1	2	•	F90	Bow	•	220	Act mill	South	Away	No	•	•	DB Pac
144	KK	No	1200	1201	Before 1300	Flood	-0.8	0.0	2	West	No	95	>50%	Standby	Standby	Yes	25	•	1	1	12	F90	Bow	•	480	Act mill	East	Lateral	Yes	•	•	DB Pac
150	KK	Yes	1200	1206	Before 1300	Ebb	2.1	0.0	8	East	No	5	<50%	All	Standby	Yes	25	•	6	1	•	F90	Bow	•	560	Polar	West	Lateral	Yes	•	Shade	DB Pac
135	KK	Yes	1200	1202	Before 1300	Ebb	1.1	0.1	8	West	No	100	>50%	Standby	Standby	Yes	200	620	2	1	•	B90	Stern	•	400	Act mill	North	Towards	No	•	•	DB Pac
145	KK	Yes	1202	1205	Before 1300	Flood	•	0.0	3	West	No	95	>50%	None	None	No	•	•	3	1	•	B60	Stern	•	180	Polar	West	Lateral	No	•	•	The 60
120	KK	Yes	1205	1207	Before 1300	Ebb	1.6	0.0	0	•	No	0	<50%	Standby	Standby	Yes	330	130	2	2	•	B60	Stern	5.791	59	Act mill	North	Towards	No	•	•	The 60
130	KK	No	1205	1210	Before 1300	Flood	-0.3	0.0	8	West	No	100	>50%	Standby	Standby	Yes	300	130	5	1	•	B60	Stern	7.01	88	Act mill	North	Towards	No	•	•	The 60
109	BF	Yes	1210	1216	Before 1300	Ebb	•	0.2	•	East	No	100	>50%	None	None	No	•	•	6	2	100	B90	Stern	•	260	Act mill	South	Away	No	3	•	DB Pac
144	KK	No	1212	1220	Before 1300	Flood	-0.8	0.0	2	West	No	95	>50%	Standby	Standby	Yes	60	•	8	1	12	F90	Bow	•	480	Act mill	East	Lateral	No	•	•	DB Pac
131	KK	Yes	1213	1215	Before 1300	Ebb	•	0.1	16	South	No	100	>50%	None	None	No	•	•	2	1	•	East 60	Side	9.449	88	Polar	West	Lateral	No	•	•	The 60
120	KK	No	1215	1220	Before 1300	Ebb	1.4	0.0	0	•	No	0	<50%	Standby	Standby	Yes	330	130	5	2	•	B60	Stern	5.791	59	Pa mill	Stat/unknown	Stationary	No	•	Movement	The 60
145	KK	No	1218	1219	Before 1300	Flood	•	0.0	3	West	No	95	>50%	None	None	No	•	•	1	1	30	B60	Stern	•	180	Act mill	West	Lateral	No	1	•	The 60
114	KK	Yes	1218	1226	Before 1300	Flood	•	0.0	3	East	No	100	>50%	None	None	No	•	•	8	2	500	B60	Stern	5.486	51	Act mill	West	Lateral	No	•	•	The 60
134	KK	No	1219	1220	Before 1300	Ebb	•	0.0	5	South	No	100	>50%	Standby	Standby	No	•	•	1	1	•	F90	Bow	•	500	Pa mill	Stat/unknown	Stationary	No	•	•	DB Pac
131	KK	Yes	1220	1222	Before 1300	Ebb	•	0.1	16	South	No	100	>50%	None	None	No	•	•	2	1	2	F60	Bow	9.449	88	Polar	East	Lateral	No	•	•	The 60
137	KK	No	1220	1222	Before 1300	Ebb	•	0.0	2	SE	No	100	>50%	Standby	Standby	Yes	280	130	2	1	•	B60	Stern	10.668	114	Act mill	North	Towards	No	•	•	The 60

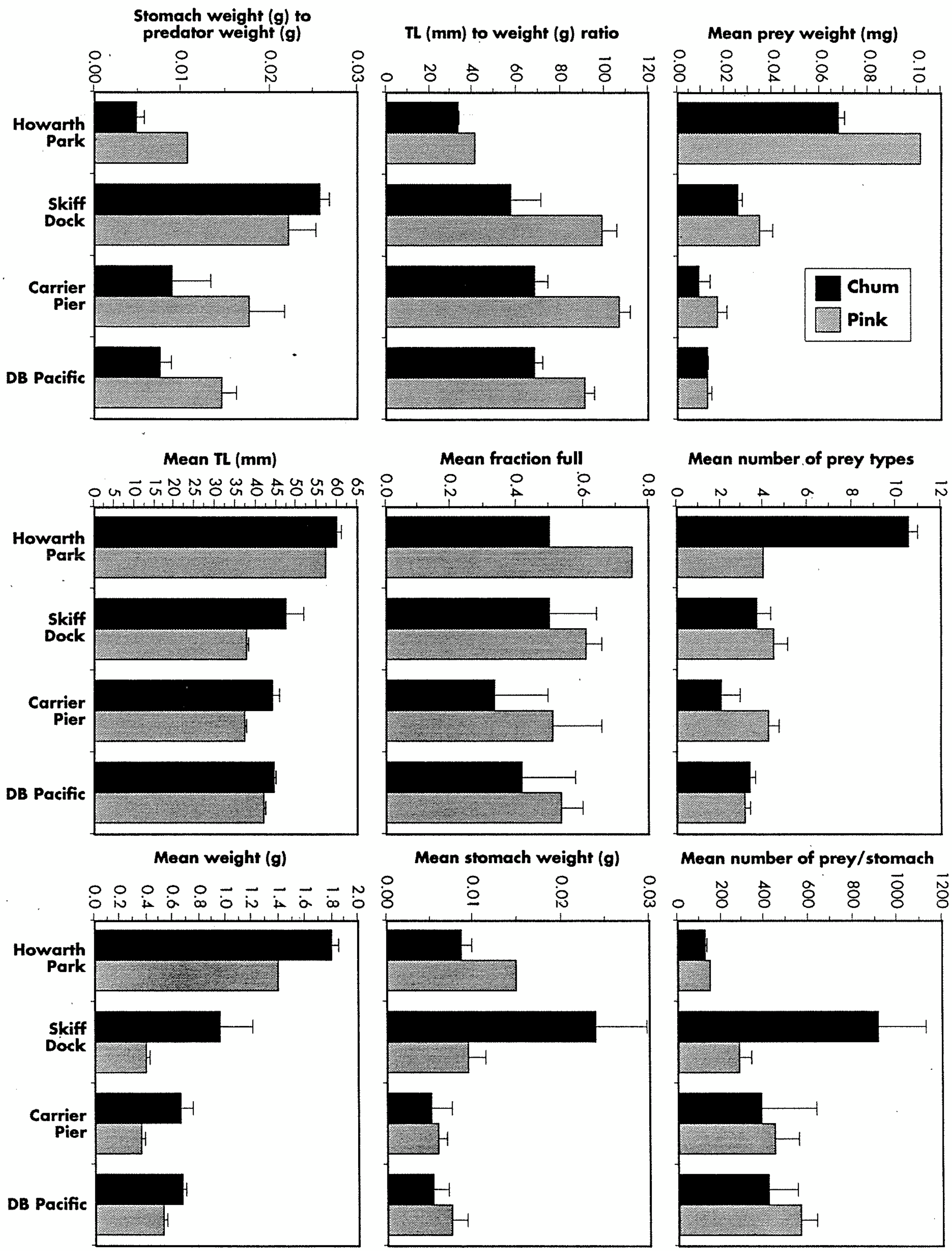
J.D.	ID	Round	Start	Stop	AM/PM	T. Stg	Tide	Wave	Wd	—>	Rain	Clds	Clds 2	DB State	60 State	Drive	DB Pile	60 Pile	Obs'	#'s	Actual	Zone	Zone 2	Depth	Shore	Behav	Behav dir	Behav Dir 2	In line?	Grebes	Other Act	Rig
135	KK	No	1221	1222	Before 1300	Ebb	0.8	0.1	8	West	No	100	>50%	Standby	Standby	Yes	200	620	1	1	•	B90	Stern	•	400	Act mill	North	Towards	No	•	•	DB Pac
131	KK	No	1222	1223	Before 1300	Ebb	•	0.1	16	South	No	100	>50%	None	None	No	•	•	1	1	1	F60	Bow	9.449	88	Polar	West	Lateral	No	•	•	The 60
109	BF	Yes	1225	1226	Before 1300	Ebb	•	0.2	•	East	No	100	>50%	None	None	No	•	•	1	1	•	SW	Side	•	260	Polar	North	Towards	No	•	•	DB Pac
149	KK	Yes	1225	1228	Before 1300	Ebb	•	0.0	11	SE	No	80	>50%	None	Standby	No	•	•	3	1	•	F90	Bow	•	480	Pa mill	Stat/unknown	Stationary	No	•	•	DB Pac
114	KK	No	1226	1229	Before 1300	Flood	•	0.0	3	East	No	100	>50%	None	None	No	•	•	3	2	100	F60	Bow	5.486	51	Polar	West	Lateral	No	•	•	The 60
131	KK	Yes	1228	1231	Before 1300	Ebb	•	0.1	16	South	No	100	>50%	None	None	No	•	•	3	1	•	F60	Bow	9.449	88	Polar	West	Lateral	No	•	•	The 60
123	KK	Yes	1228	1229	Before 1300	Flood	2.1	0.2	16	West	No	100	>50%	Standby	Standby	Yes	•	120	1	1	•	East 60	Side	7.315	74	Act mill	West	Lateral	No	•	•	The 60
120	KK	Yes	1232	1234	Before 1300	Ebb	1.2	0.0	0	•	No	0	<50%	All	Standby	Yes	30	430	2	2	•	F90	Bow	•	220	Act mill	North	Towards	Yes	•	•	DB Pac
149	KK	Yes	1235	1236	Before 1300	Ebb	•	0.0	11	SE	No	80	>50%	None	Standby	No	•	•	1	1	•	B90	Stern	•	480	Act mill	South	Away	No	•	•	DB Pac
130	KK	No	1236	1238	Before 1300	Flood	-2.1	0.0	8	West	No	100	>50%	Standby	Standby	Yes	300	130	2	1	•	B60	Stern	7.01	88	Act mill	North	Towards	No	•	•	The 60
152	KK	Yes	1236	1237	Before 1300	Flood	2.5	0.2	11	SE	Yes	100	>50%	Standby	Standby	Yes	200	•	1	1	6	B90	Stern	•	520	Act mill	South	Away	No	•	•	DB Pac
145	KK	No	1237	1238	Before 1300	Flood	•	0.0	3	West	No	95	>50%	None	None	No	•	•	1	1	30	B60	Stern	•	180	Act mill	West	Lateral	No	•	•	The 60
120	KK	Yes	1237	1238	Before 1300	Ebb	1.2	0.0	0	•	No	0	<50%	All	Standby	Yes	200	540	1	1	•	B90	Stern	•	220	Act mill	South	Away	No	•	•	DB Pac
138	KK	Yes	1238	1254	Before 1300	Ebb	2.1	0.0	3	West	No	95	>50%	Standby	Standby	Yes	290	130	16	1	•	F60	Bow	10.668	102	Act mill	North	Towards	No	•	Boat	The 60
144	KK	No	1240	1254	Before 1300	Flood	-0.4	0.0	0	•	No	95	>50%	All	Standby	Yes	50	•	14	1	25	F90	Bow	•	480	Act mill	North	Towards	No	•	Misc	DB Pac
137	KK	No	1240	1242	Before 1300	Ebb	•	0.0	2	SE	No	100	>50%	Standby	Standby	Yes	280	130	2	1	•	B60	Stern	10.668	114	Act mill	North	Towards	No	•	•	The 60
145	KK	Yes	1242	1243	Before 1300	Flood	•	0.0	3	West	No	95	>50%	None	None	No	•	•	1	1	1	East 60	Side	•	180	Act mill	East	Lateral	No	•	•	The 60
152	KK	Yes	1243	1244	Before 1300	Flood	2.5	0.2	11	SE	Yes	100	>50%	All	Standby	Yes	60	•	1	1	2	F90	Bow	•	520	Pa mill	Stat/unknown	Stationary	Yes	•	•	DB Pac
156	KK	Yes	1245	1256	Before 1300	Flood	1.3	0.0	3	West	No	20	<50%	Standby	Standby	Yes	200	•	11	1	4	NW	Side	•	600	Polar	South	Away	No	•	Shade	DB Pac
129	KK	Yes	1247	1252	Before 1300	Flood	0.3	0.0	11	West	No	0	<50%	Standby	Standby	Yes	600	130	5	2	•	B60	Stern	5.182	81	Act mill	West	Lateral	No	•	•	The 60
141	KK	Yes	1247	1250	Before 1300	Flood	1.7	0.1	8	West	No	50	>50%	Standby	Standby	Yes	400	130	3	1	•	B60	Stern	12.192	102	Act mill	West	Lateral	No	•	•	The 60
145	KK	No	1250	1251	Before 1300	Flood	•	0.0	3	West	No	95	>50%	None	None	No	•	•	1	1	•	B60	Stern	•	180	Act mill	West	Lateral	No	•	•	The 60
123	KK	Yes	1250	1305	Before 1300	Flood	2.2	0.1	8	West	No	100	>50%	Standby	All	Yes	•	20	15	1	•	East 60	Side	7.315	81	Polar	North	Towards	Yes	•	•	The 60
131	KK	Yes	1252	1256	Before 1300	Ebb	•	0.1	16	South	No	100	>50%	None	None	No	•	•	4	1	•	B60	Stern	9.449	88	Polar	South	Away	No	•	•	The 60
124	KK	Yes	1253	1255	Before 1300	Flood	•	0.0	3	West	No	0	<50%	None	None	No	•	•	2	1	•	East 60	Side	6.096	74	Act mill	East	Lateral	No	•	•	The 60
136	KK	Yes	1256	1257	Before 1300	Ebb	1.1	0.0	3	South	No	40	<50%	Standby	All	Yes	340	70	1	1	•	F60	Bow	10.668	102	Act mill	East	Lateral	No	•	•	The 60
128	KK	Yes	1256	1257	Before 1300	Flood	0.4	0.0	8	West	No	0	<50%	Standby	Standby	Yes	470	80	1	1	5	East 60	Side	4.572	74	Polar	South	Away	No	•	•	The 60
124	KK	Yes	1257	1258	Before 1300	Flood	•	0.0	3	West	No	0	<50%	None	None	No	•	•	1	1	•	East 60	Side	6.096	74	Polar	North	Towards	No	•	•	The 60
124	KK	Yes	1300	1301	After 1300	Flood	•	0.0	3	West	No	0	<50%	None	None	No	•	•	1	1	•	F60	Bow	6.096	74	Polar	West	Lateral	No	•	Shade	The 60
145	KK	No	1300	1302	After 1300	Flood	•	0.0	0	•	No	95	>50%	None	None	No	•	•	2	1	•	NW	Side	•	480	Polar	North	Towards	No	•	•	DB Pac
144	KK	No	1300	1315	After 1300	Flood	-0.3	0.0	0	•	No	95	>50%	All	Standby	Yes	45	•	15	1	25	F90	Bow	•	480	Polar	West	Lateral	Yes	•	•	DB Pac
149	KK	Yes	1302	1303	After 1300	Ebb	•	0.0	11	SE	No	80	>50%	None	Standby	No	•	•	1	1	2	NW	Side	•	480	Polar	South	Away	No	•	•	DB Pac
121	KK	Yes	1303	1313	After 1300	Ebb	1.5	0.0	5	South	No	100	>50%	All	Standby	Yes	120	430	10	2	•	NW	Side	•	340	Act mill	South	Away	No	•	•	DB Pac
137	KK	No	1303	1305	After 1300	Ebb	1.6	0.0	2	SE	No	100	>50%	Standby	All	Yes	280	130	2	1	•	B60	Stern	10.668	102	Act mill	North	Towards	No	•	•	The 60
117	KK	Yes	1306	1318	After 1300	Ebb	-0.9	0.0	8	East	No	100	>50%	Standby	Standby	Yes	45	290	12	2	•	F90	Bow	•	220	Act mill	West	Lateral	No	•	•	DB Pac
145	KK	Yes	1306	1311	After 1300	Flood	•	0.0	0	•	No	95	>50%	None	None	No	•	•	5	1	•	F90	Bow	•	480	Act mill	North	Towards	No	•	•	DB Pac
116	KK	Yes	1306	1310	After 1300	Flood	•	0.0	8	West	No	100	>50%	None	Standby	No	•	•	4	2	•	B60	Stern	9.144	59	Act mill	West	Lateral	No	•	•	The 60
156	KK	No	1307	1308	After 1300	Flood	1.5	0.0	3	West	No	20	<50%	All	Standby	Yes	50	•	1	1	4	NW	Side	•	600	Polar	North	Towards	Yes	•	Shade	DB Pac
141	KK	No	1307	1309	After 1300	Flood	2.0	0.1	8	West	No	50	>50%	Standby	All	Yes	450	80	2	1	•	East 60	Side	12.192	108	Polar	South	Away	No	•	•	The 60
122	KK	Yes	1308	1311	After 1300	Ebb	2.1	0.0	8	West	No	100	>50%	Standby	Standby	Yes	220	50	3	1	4	East 60	Side	7.01	81	Polar	North	Towards	No	•	•	The 60
138	KK	Yes	1308	1314	After 1300	Ebb	2.0	0.0	3	West	No	95	>50%	All	Standby	Yes	410	70	6	1	•	B60	Stern	10.668	108	Pa mill	Stat/unknown	Stationary	No	•	•	The 60
130	KK	Yes	1310	1312	After 1300	Flood	0.0	0.0	8	West	No	100	>50%	Standby	All	Yes	300	130	2	1	•	B60	Stern	6.096	88	Act mill	North	Towards	No	•	•	The 60
150	KK	Yes	1310	1315	After 1300	Ebb	•	0.0	11	West	No	5	<50%	Standby	Standby	Yes	•	•	5	1	•	F90	Bow	•	560	Act mill	East	Lateral	No	•	•	DB Pac
123	KK	Yes	1310	1312	After 1300	Flood	2.2	0.1	8	West	No	100	>50%	Standby	Standby	Yes	•	20	2	1	1	East 60	Side	7.315	81	Polar	North	Towards	No	•	•	The 60
124	KK	No	1312	1313	After 1300	Flood	•	0.0	3	West	No	0	<50%	None	None	No	•	•	1	1	•	East 60	Side	6.096	74	Polar	West	Lateral	No	•	•	The 60
122	KK	No	1315	1316	After 1300	Ebb	2.0	0.0	8	West	No	100	>50%	Standby	Standby	Yes	150	100	1	1	4	East 60	Side	7.01	81	Polar	South	Away	No	•	•	The 60
123	KK	Yes	1316	1317	After 1300	Ebb	2.2	0.1	8	West	No	100	>50%	Standby	Standby	Yes	•	130	1	1	•	B60	Stern	7.315	81	Act mill	East	Lateral	No	•	•	The 60
129	KK	No	1317	1319	After 1300	Flood	0.3	0.0	11	West	No	0	<50%	Standby	Standby	Yes	680	50	2	2	•	East 60	Side	6.401	81	Polar	North	Towards	No	•	Boat	The 60
114	KK	Yes	1318	1319	After 1300	Flood	•	0.0	3	East	Yes	90	>50%	None	None	No	•	•	1	1	200	F90	Bow	•	280	Pa mill	Stat/unknown	Stationary	No	•	•	DB Pac
136	KK	No	1319	1329	After 1300	Ebb	0.9	0.0	3	South	No	30	<50%	Standby	All	Yes	340	70	10	1	•	F60	Bow	10.668	108	Act mill	West	Lateral	Yes	•	Boat	The 60
117	KK	Yes	1320	1323	After 1300	Ebb	-0.9	0.0	8	East	No	100	>50%	All	All	Yes	45	290	3	2	•	F90	Bow	•	220	Act mill	West	Lateral	Yes	•	•	DB Pac
116	KK	No	1320	1322	After 1300	Flood	•	0.0	8	West	No	100	>50%	None	Standby	No	•	•	2	2	•	B60	Stern	9.144	59	Act mill	North	Towards	No	•	•	The 60
150	KK	Yes	1320	1321	After 1300	Ebb	•	0.0	11	West	No	5	<50%	Standby	Standby	Yes	•	•	1	1	•	B90	Stern	•	560	Pa mill	Stat/unknown	Stationary	No	•	•	DB Pac

J.D.	ID	Round	Start	Stop	AM/PM	T. Stg	Tide	Wave	Wd	—>	Rain	Clds	Clds 2	DB State	60 State	Drive	DB Pile	60 Pile	Obs'	#'s	Actual	Zone	Zone 2	Depth	Shore	Behav	Behav dir	Behav Dir 2	In line?	Grebes	Other Act	Rig
114	KK	No	1321	1326	After 1300	Flood	•	0.0	3	East	Yes	90	>50%	None	None	No	•	•	5	3	1000	F90	Bow	•	280	Act mill	West	Lateral	No	24	•	DB Pac
101	BF	Yes	1325	1331	After 1300	Flood	0.0	0.0	•	•	No	100	>50%	All	Standby	Yes	200	640	6	2	500	B90	Stern	•	200	Pa mill	Stat/unknown	Stationary	No	•	•	DB Pac
122	KK	Yes	1325	1345	After 1300	Ebb	2.0	0.0	8	West	No	100	>50%	Standby	Standby	Yes	80	290	20	1	•	F90	Bow	•	360	Act mill	West	Lateral	No	•	•	DB Pac
145	KK	No	1326	1328	After 1300	Flood	•	0.0	0	•	No	95	>50%	None	None	No	•	•	2	1	•	F90	Bow	•	480	Act mill	North	Towards	No	•	•	DB Pac
143	KK	Yes	1328	1341	After 1300	Flood	0.9	0.0	3	West	No	100	>50%	Standby	Standby	Yes	230	•	13	1	•	B90	Stern	•	520	Act mill	North	Towards	No	•	•	DB Pac
128	KK	Yes	1329	1330	After 1300	Flood	0.9	0.0	8	West	No	0	<50%	Standby	Standby	Yes	470	130	1	1	6	B60	Stern	4.877	81	Polar	South	Away	No	•	•	The 60
138	KK	No	1330	1332	After 1300	Ebb	2.0	0.0	3	West	No	95	>50%	Standby	All	Yes	460	130	2	1	•	B60	Stern	10.668	114	Pa mill	Stat/unknown	Stationary	No	•	•	The 60
149	KK	Yes	1332	1333	After 1300	Ebb	•	0.1	16	South	No	70	>50%	None	Standby	No	•	•	1	1	2	SW	Side	•	480	Polar	South	Away	No	•	Boat	DB Pac
123	KK	Yes	1333	1334	After 1300	Ebb	2.2	0.0	8	West	No	100	>50%	Standby	Standby	Yes	•	•	1	1	•	F60	Bow	7.01	74	Polar	North	Towards	No	•	•	The 60
123	KK	No	1334	1342	After 1300	Ebb	2.2	0.0	8	West	No	100	>50%	Standby	Standby	Yes	•	•	8	1	•	East 60	Side	7.01	74	Polar	North	Towards	No	•	•	The 60
109	BF	Yes	1335	1340	After 1300	Ebb	•	0.0	•	•	Yes	100	>50%	None	None	No	•	•	5	2	•	B90	Stern	•	260	Pa mill	Stat/unknown	Stationary	No	•	•	DB Pac
101	BF	Yes	1335	1336	After 1300	Flood	0.0	0.0	•	•	No	100	>50%	All	Standby	Yes	60	470	1	3	•	NW	Side	•	200	Act mill	South	Away	No	•	•	DB Pac
141	KK	Yes	1336	1430	After 1300	Flood	2.2	0.1	8	West	No	50	>50%	Standby	All	Yes	480	20	54	1	•	East 60	Side	14.021	114	Polar	West	Lateral	No	•	•	The 60
121	KK	Yes	1336	1337	After 1300	Ebb	1.2	0.0	8	West	No	100	>50%	Standby	All	Yes	580	130	1	1	•	B60	Stern	5.486	59	Act mill	North	Towards	No	•	•	The 60
127	KK	Yes	1338	1339	After 1300	Flood	•	0.2	8	West	No	90	>50%	Standby	Standby	No	•	•	1	1	•	NW	Side	•	260	Polar	South	Away	No	•	•	DB Pac
114	KK	Yes	1338	1343	After 1300	Flood	•	0.0	3	East	No	50	>50%	None	None	No	•	•	5	3	1000	F90	Bow	•	280	Act mill	South	Away	No	•	•	DB Pac
136	KK	Yes	1342	1350	After 1300	Ebb	0.8	0.0	3	South	No	30	<50%	Standby	Standby	Yes	160	130	8	1	•	B60	Stern	10.668	108	Pa mill	Stat/unknown	Stationary	No	•	•	The 60
114	KK	No	1343	1405	After 1300	Flood	•	0.0	3	East	No	50	>50%	None	None	No	•	•	22	3	1000	NW	Side	•	280	Act mill	South	Away	No	•	Shade	DB Pac
116	KK	Yes	1345	1351	After 1300	Flood	•	0.0	8	West	No	100	>50%	None	Standby	No	•	•	6	2	•	F90	Bow	•	380	Act mill	West	Lateral	No	•	•	DB Pac
130	KK	Yes	1345	1346	After 1300	Flood	0.3	0.0	2	West	No	100	>50%	Standby	Standby	Yes	200	490	1	1	•	B90	Stern	•	300	Act mill	North	Towards	No	•	•	DB Pac
130	KK	Yes	1345	1346	After 1300	Flood	0.3	0.0	2	West	No	100	>50%	Standby	Standby	Yes	200	490	1	1	•	B90	Stern	•	300	Polar	South	Away	No	•	•	DB Pac
138	KK	No	1347	1348	After 1300	Ebb	1.9	0.0	3	West	No	60	>50%	Standby	Standby	Yes	390	130	1	1	•	B60	Stern	11.887	119	Pa mill	Stat/unknown	Stationary	No	•	•	The 60
123	KK	Yes	1350	1352	After 1300	Ebb	2.1	0.0	8	West	No	100	>50%	Standby	All	Yes	•	130	2	1	•	B60	Stern	5.791	81	Act mill	West	Lateral	No	•	•	The 60
138	KK	No	1352	1353	After 1300	Ebb	1.9	0.0	3	West	No	60	>50%	Standby	All	Yes	370	40	1	1	1	East 60	Side	11.887	119	Polar	South	Away	No	•	•	The 60
123	KK	No	1354	1355	After 1300	Ebb	2.1	0.0	8	West	No	100	>50%	Standby	All	Yes	•	6	1	1	•	F60	Bow	5.791	81	Act mill	North	Towards	Yes	100	•	The 60
124	KK	Yes	1357	1358	After 1300	Flood	•	0.2	16	West	No	0	<50%	None	None	No	•	•	1	1	•	F90	Bow	•	260	Polar	West	Lateral	No	•	•	DB Pac
116	KK	Yes	1357	1358	After 1300	Flood	•	0.0	8	West	No	100	>50%	None	Standby	No	•	•	1	2	•	B90	Stern	•	380	Act mill	East	Lateral	No	200	•	DB Pac
143	KK	No	1400	1402	After 1300	Flood	1.4	0.0	3	West	Yes	100	>50%	Standby	Standby	Yes	200	•	2	1	•	B90	Stern	•	520	Act mill	North	Towards	No	•	•	DB Pac
129	KK	Yes	1401	1402	After 1300	Flood	0.6	0.2	16	West	No	0	<50%	All	All	Yes	480	80	1	1	•	East 60	Side	6.706	81	Polar	South	Away	No	•	•	The 60
116	KK	Yes	1402	1403	After 1300	Flood	•	0.0	8	West	No	100	>50%	None	Standby	No	•	•	1	1	•	SW	Side	•	380	Polar	South	Away	No	•	•	DB Pac
150	KK	Yes	1404	1406	After 1300	Ebb	•	0.0	8	West	No	5	<50%	Standby	Standby	Yes	•	•	2	1	•	NW	Side	•	560	Act mill	North	Towards	No	•	•	DB Pac
94	BF	Yes	1406	1407	After 1300	Ebb	2.4	0.1	16	NW	No	0	<50%	Standby	All	Yes	400	120	1	2	•	East 60	Side	2.134	9	•	Stat/unknown	Stationary	No	•	•	The 60
124	KK	Yes	1406	1410	After 1300	Flood	•	0.2	16	West	No	0	<50%	None	None	No	•	•	4	2	•	B90	Stern	•	260	Act mill	North	Towards	No	•	•	DB Pac
130	KK	No	1407	1410	After 1300	Flood	0.5	0.0	8	West	No	100	>50%	All	All	Yes	200	490	3	1	•	B90	Stern	•	•	Act mill	North	Towards	No	•	•	DB Pac
116	KK	Yes	1410	1411	After 1300	Flood	•	0.0	8	West	No	100	>50%	None	Standby	No	•	•	1	1	•	NW	Side	•	380	Polar	North	Towards	No	•	•	DB Pac
120	KK	Yes	1410	1415	After 1300	Ebb	0.2	0.0	0	•	No	0	<50%	All	Standby	Yes	200	540	5	2	•	B90	Stern	•	240	Act mill	South	Away	No	•	•	DB Pac
127	KK	No	1412	1415	After 1300	Flood	•	0.2	8	West	No	80	>50%	Standby	Standby	No	•	•	3	1	•	F90	Bow	•	260	Polar	East	Lateral	No	•	•	DB Pac
138	KK	No	1412	1413	After 1300	Ebb	1.7	0.0	3	West	No	60	>50%	All	Standby	Yes	380	130	1	1	•	B60	Stern	11.887	119	Pa mill	Stat/unknown	Stationary	No	•	•	The 60
149	KK	Yes	1414	1415	After 1300	Ebb	•	0.1	16	South	No	70	>50%	None	Standby	No	•	•	1	1	•	B90	Stern	•	480	Act mill	South	Away	No	•	•	DB Pac
122	KK	Yes	1414	1416	After 1300	Ebb	1.7	0.0	8	West	No	100	>50%	Standby	All	Yes	210	130	2	2	•	B60	Stern	7.315	81	Pa mill	Stat/unknown	Stationary	No	•	•	The 60
124	KK	Yes	1415	1416	After 1300	Flood	•	0.2	16	West	No	0	<50%	None	None	No	•	•	1	1	•	NW	Side	•	260	Polar	North	Towards	No	•	•	DB Pac
114	KK	Yes	1417	1418	After 1300	Flood	•	0.0	8	West	No	0	<50%	None	None	No	•	•	1	3	•	B60	Stern	5.486	51	Pa mill	Stat/unknown	Stationary	No	•	•	The 60
115	BF	•	1418	1422	After 1300	Flood	0.8	0.3	16	West	No	60	>50%	Standby	Standby	Yes	200	490	4	3	•	B90	Stern	•	300	Act mill	East	Lateral	No	2	•	DB Pac
116	KK	No	1418	1419	After 1300	Flood	•	0.0	8	West	No	100	>50%	None	Standby	No	•	•	1	1	•	SW	Side	•	380	Polar	South	Away	No	•	•	DB Pac
150	KK	Yes	1420	1425	After 1300	Ebb	•	0.0	8	West	No	5	<50%	Standby	Standby	Yes	•	•	5	1	•	B90	Stern	•	560	Act mill	North	Towards	No	•	•	DB Pac
143	KK	No	1420	1421	After 1300	Flood	1.7	0.0	3	West	No	100	>50%	Standby	Standby	Yes	200	•	1	1	•	B90	Stern	•	520	Act mill	North	Towards	No	•	•	DB Pac
122	KK	No	1420	1438	After 1300	Ebb	1.6	0.0	8	West	No	95	>50%	All	Standby	Yes	60	330	18	2	•	F90	Bow	•	260	Pa mill	Stat/unknown	Stationary	Yes	40	•	DB Pac
129	KK	Yes	1421	1422	After 1300	Flood	1.0	0.2	16	West	No	0	<50%	Standby	Standby	Yes	540	80	1	1	•	B60	Stern	6.706	81	Polar	South	Away	No	•	•	The 60
116	KK	Yes	1422	1425	After 1300	Flood	•	0.0	8	West	No	100	>50%	None	Standby	No	•	•	3	2	•	F90	Bow	•	380	Act mill	South	Away	No	•	•	DB Pac
149	KK	Yes	1424	1425	After 1300	Ebb	•	0.0	16	SE	No	70	>50%	None	Standby	No	•	•	1	1	4	F60	Bow	•	130	Polar	West	Lateral	No	•	•	The 60
144	KK	Yes	1425	1427	After 1300	Flood	0.6	0.0	0	•	No	60	>50%	None	Standby	Yes	•	•	2	1	5	F90	Bow	•	480	Polar	East	Lateral	No	1	•	DB Pac
127	KK	Yes	1429	1432	After 1300	Flood	•	0.2	8	West	No	80	>50%	Standby	Standby	No	•	•	3	1	•	F90	Bow	•	260	Act mill	West	Lateral	No	•	•	DB Pac
130	KK	Yes	1430	1432	After 1300	Flood	0.7	0.1	8	NW	No	100	>50%	Standby	All	Yes	200	410	2	1	•	B90	Stern	•	300	Pa mill	Stat/unknown	Stationary	No	•	•	DB Pac

J.D.	ID	Round	Start	Stop	AM/PM	T. Stg	Tide	Wave	Wd	—>	Rain	Clds	Clds 2	DB State	60 State	Drive	DB Pile	60 Pile	Obs'	#'s	Actual	Zone	Zone 2	Depth	Shore	Behav	Behav dir	Behav Dir 2	In line?	Grebes	Other Act	Rig
137	KK	Yes	1431	1443	After 1300	Ebb	1.1	0.0	3	West	No	95	>50%	All	All	Yes	40	380	2	1	•	F90	Bow	•	440	Act mill	South	Away	Yes	1	•	DB Pac
150	KK	No	1433	1434	After 1300	Ebb	•	0.0	8	West	No	5	<50%	Standby	Standby	Yes	•	•	1	1	•	NW	Side	•	560	Polar	South	Away	No	•	•	DB Pac
127	KK	No	1433	1438	After 1300	Flood	•	0.0	8	West	No	70	>50%	Standby	Standby	No	•	•	5	1	•	NW	Side	•	260	Act mill	East	Lateral	No	•	Shade	DB Pac
117	KK	No	1434	1435	After 1300	Flood	-0.3	0.0	8	East	No	100	>50%	All	Standby	Yes	45	310	1	2	•	F90	Bow	•	300	Act mill	West	Lateral	No	•	•	DB Pac
136	KK	No	1435	1445	After 1300	Ebb	0.3	0.0	3	SW	No	30	<50%	Standby	Standby	Yes	200	460	10	1	•	B90	Stern	•	340	Polar	South	Away	No	•	•	DB Pac
143	KK	No	1436	1443	After 1300	Flood	2.0	0.0	3	West	No	100	>50%	All	Standby	Yes	200	•	7	1	•	B90	Stern	•	520	Act mill	North	Towards	No	•	•	DB Pac
149	KK	Yes	1437	1438	After 1300	Ebb	•	0.0	16	SE	No	70	>50%	None	Standby	No	•	•	1	1	1	F60	Bow	•	130	Polar	North	Towards	No	•	•	The 60
92	BF	No	1437	1440	After 1300	Ebb	•	•	•	•	No	50	>50%	All	Standby	Yes	•	•	3	2	500	East 60	Side	12.192	20	Polar	South	Away	No	•	•	The 60
150	KK	No	1438	1439	After 1300	Ebb	•	0.0	8	West	No	5	<50%	Standby	Standby	Yes	•	•	1	1	9	F90	Bow	•	560	Polar	West	Lateral	No	•	Shade	DB Pac
115	BF	•	1438	1439	After 1300	Flood	1.1	0.3	16	West	No	60	>50%	Standby	Standby	Yes	200	490	1	2	•	B90	Stern	•	300	Pa mill	Stat/unknown	Stationary	No	•	•	DB Pac
115	BF	No	1439	1440	After 1300	Flood	1.1	0.3	16	West	No	60	>50%	Standby	Standby	Yes	200	490	1	3	•	B90	Stern	•	300	Polar	South	Away	No	•	•	DB Pac
92	BF	No	1441	1444	After 1300	Ebb	•	•	•	•	No	50	>50%	All	Standby	Yes	•	•	3	3	•	F60	Bow	6.096	20	Pa mill	Stat/unknown	Stationary	Yes	•	•	The 60
114	KK	Yes	1441	1442	After 1300	Flood	•	0.0	8	West	No	0	<50%	None	None	No	•	•	1	1	1	F60	Bow	5.486	51	Polar	West	Lateral	No	•	•	The 60
149	KK	Yes	1443	1445	After 1300	Ebb	•	0.0	16	SE	No	60	>50%	None	Standby	No	•	•	2	1	10	East 60	Side	•	130	Polar	North	Towards	No	•	•	The 60
122	KK	Yes	1443	1455	After 1300	Ebb	1.4	0.0	8	West	No	100	>50%	Standby	Standby	Yes	220	130	12	2	•	B60	Stern	7.315	81	Pa mill	Stat/unknown	Stationary	No	•	•	The 60
143	KK	Yes	1446	1447	After 1300	Flood	2.0	0.0	3	West	No	100	>50%	Standby	Standby	Yes	200	•	1	1	2	SW	Side	•	520	Polar	South	Away	No	•	•	DB Pac
135	KK	Yes	1446	1448	After 1300	Ebb	-0.1	0.1	8	West	No	100	>50%	Standby	Standby	Yes	200	700	2	1	•	B90	Stern	•	400	Act mill	South	Away	No	•	•	DB Pac
124	KK	Yes	1447	1448	After 1300	Flood	•	0.2	16	West	No	0	<50%	None	None	No	•	•	1	1	•	East 60	Side	6.096	74	Polar	West	Lateral	No	•	•	The 60
142	KK	Yes	1447	1448	After 1300	Flood	2.6	0.0	8	East	No	50	>50%	Standby	All	Yes	60	680	1	1	•	NW	Side	•	440	Act mill	North	Towards	No	•	•	DB Pac
150	KK	No	1448	1450	After 1300	Ebb	•	0.0	8	West	No	5	<50%	Standby	Standby	Yes	•	•	2	1	6	SW	Side	•	560	Polar	North	Towards	No	•	•	DB Pac
129	KK	Yes	1448	1449	After 1300	Flood	1.2	0.3	16	West	No	0	<50%	Standby	Standby	Yes	220	710	1	1	•	F90	Bow	•	360	Polar	South	Away	No	3	•	DB Pac
138	KK	Yes	1450	1456	After 1300	Ebb	1.6	0.1	5	West	No	60	>50%	All	All	Yes	200	600	6	1	•	B90	Stern	•	380	Act mill	West	Lateral	No	•	•	DB Pac
124	KK	Yes	1451	1452	After 1300	Flood	•	0.2	16	West	No	0	<50%	None	None	No	•	•	1	1	•	F60	Bow	6.096	74	Polar	South	Away	No	•	•	The 60
108	BF	Yes	1452	1453	After 1300	Ebb	1.2	•	•	•	No	•	•	All	Standby	Yes	10	610	1	2	•	F90	Bow	•	260	Pa mill	Stat/unknown	Stationary	Yes	•	•	DB Pac
141	KK	Yes	1455	1458	After 1300	Flood	2.7	0.0	3	East	No	90	>50%	All	Standby	Yes	15	520	3	1	•	F90	Bow	•	500	Polar	West	Lateral	No	•	•	DB Pac
135	KK	Yes	1457	1508	After 1300	Ebb	-0.1	0.1	8	SW	No	100	>50%	All	Standby	Yes	100	520	11	1	•	NW	Side	•	420	Polar	South	Away	No	•	Misc	DB Pac
142	KK	Yes	1458	1500	After 1300	Flood	2.6	0.0	8	East	No	50	>50%	Standby	Standby	Yes	120	710	2	2	•	NW	Side	•	440	Act mill	South	Away	No	•	•	DB Pac
115	BF	•	1458	1459	After 1300	Flood	1.1	0.3	16	West	No	60	>50%	All	Standby	Yes	200	490	1	2	•	B90	Stern	•	300	Pa mill	Stat/unknown	Stationary	No	•	•	DB Pac
92	BF	Yes	1500	1520	After 1300	Ebb	0.3	0.0	•	•	No	0	<50%	Standby	All	Yes	•	•	20	3	•	F60	Bow	0.914	9	Pa mill	Stat/unknown	Stationary	No	•	•	The 60
116	KK	Yes	1500	1504	After 1300	Flood	•	0.0	8	West	No	100	>50%	None	Standby	No	•	•	4	2	•	B60	Stern	9.144	59	Act mill	North	Towards	No	•	•	The 60
150	KK	No	1500	1502	After 1300	Ebb	•	0.0	8	West	No	5	<50%	Standby	Standby	Yes	•	•	2	1	2	NW	Side	•	560	Polar	West	Lateral	No	•	•	DB Pac
136	KK	Yes	1502	1505	After 1300	Ebb	0.2	0.0	3	SW	No	60	>50%	Standby	Standby	Yes	200	450	3	1	•	B90	Stern	•	340	Act mill	South	Away	No	•	•	DB Pac
130	KK	Yes	1503	1505	After 1300	Flood	1.1	0.1	8	NW	No	100	>50%	Standby	Standby	Yes	200	530	2	1	40	B90	Stern	•	300	Act mill	North	Towards	No	•	•	DB Pac
143	KK	Yes	1505	1507	After 1300	Flood	2.3	0.0	3	West	No	100	>50%	All	Standby	Yes	15	•	2	1	5	NW	Side	•	520	Polar	North	Towards	Yes	•	•	DB Pac
141	KK	Yes	1505	1513	After 1300	Flood	2.9	0.0	3	East	No	90	>50%	All	All	Yes	200	700	8	2	•	B90	Stern	•	500	Polar	North	Towards	No	•	•	DB Pac
150	KK	Yes	1505	1510	After 1300	Ebb	•	0.0	8	West	No	5	<50%	Standby	Standby	Yes	•	•	5	1	9	NW	Side	•	560	Polar	North	Towards	No	•	•	DB Pac
115	BF	•	1506	1507	After 1300	Flood	1.1	0.3	16	West	No	60	>50%	All	Standby	Yes	200	490	1	3	•	B90	Stern	•	300	Pa mill	Stat/unknown	Stationary	No	•	•	DB Pac
138	KK	Yes	1508	1512	After 1300	Ebb	1.6	0.1	5	West	No	70	>50%	Standby	Standby	Yes	150	480	4	1	5	NW	Side	•	380	Polar	North	Towards	No	•	•	DB Pac
135	KK	No	1515	1520	After 1300	Ebb	-0.1	0.1	8	SW	No	100	>50%	Standby	Standby	Yes	200	550	5	1	•	SW	Side	•	420	Polar	North	Towards	No	•	Boat	DB Pac
143	KK	No	1517	1518	After 1300	Flood	2.5	0.0	3	West	No	100	>50%	Standby	Standby	Yes	100	•	1	1	5	NW	Side	•	520	Polar	South	Away	No	•	•	DB Pac
138	KK	Yes	1520	1604	After 1300	Ebb	1.3	0.1	8	West	No	70	>50%	All	All	Yes	400	25	44	1	50	East 60	Side	11.278	119	Act mill	South	Away	Yes	•	Movement	The 60
134	KK	Yes	1520	1525	After 1300	Flood	•	0.0	5	SE	No	100	>50%	None	Standby	No	•	•	5	1	•	NW	Side	•	400	Polar	South	Away	No	5	•	DB Pac
150	KK	Yes	1520	1525	After 1300	Ebb	•	0.0	8	West	No	5	<50%	Standby	Standby	Yes	•	•	5	1	9	B90	Stern	•	560	Act mill	North	Towards	No	•	•	DB Pac
110	KK	No	1520	1521	After 1300	Ebb	2.1	•	0	•	No	100	>50%	Standby	Standby	Yes	60	230	1	2	250	F90	Bow	•	180	Polar	South	Away	No	•	•	DB Pac
141	KK	No	1523	1545	After 1300	Flood	2.9	0.0	16	East	Yes	100	>50%	All	Standby	Yes	25	510	22	1	•	F90	Bow	•	500	Act mill	North	Towards	Yes	•	•	DB Pac
116	KK	No	1525	1528	After 1300	Flood	•	0.0	8	West	No	100	>50%	None	Standby	No	•	•	3	2	•	B60	Stern	9.144	59	Act mill	South	Away	No	•	•	The 60
92	BF	Yes	1525	1526	After 1300	Ebb	0.3	0.0	•	•	No	0	<50%	Standby	Standby	Yes	•	•	1	2	•	East 60	Side	0.914	9	Pa mill	Stat/unknown	Stationary	No	•	•	The 60
92	BF	Yes	1526	1531	After 1300	Ebb	0.3	0.0	•	•	No	0	<50%	Standby	Standby	Yes	•	•	5	3	•	B60	Stern	0.914	9	Act mill	East	Lateral	No	•	•	The 60
127	KK	Yes	1528	1529	After 1300	Flood	•	0.0	8	West	No	40	<50%	None	None	No	•	•	1	1	1	F60	Bow	6.096	74	Polar	West	Lateral	No	6	•	The 60
127	KK	Yes	1530	1535	After 1300	Flood	•	0.0	8	West	No	40	<50%	None	None	No	•	•	5	1	6	F60	Bow	15.24	74	Polar	South	Away	No	10	•	The 60
137	KK	No	1530	1535	After 1300	Ebb	0.6	0.0	3	West	No	60	>50%	All	None	Yes	25	460	5	1	•	F90	Bow	•	440	Act mill	South	Away	Yes	•	•	DB Pac
110	KK	Yes	1530	1533	After 1300	Ebb	2.1	•	0	•	No	100	>50%	All	Standby	Yes	30	200	3	3	1000	F90	Bow	•	180	Polar	East	Lateral	Yes	•	•	DB Pac
106	BF	No	1530	1532	After 1300	Ebb	•	•	•	•	No	0	<50%	Standby	Standby	Yes	•	•	2	2	•	F90	Bow	•	•	Polar	West	Lateral	•	•	•	DB Pac

J.D.	ID	Round	Start	Stop	AM/PM	T. Stg	Tide	Wave	Wd	—>	Rain	Clds	Clds 2	DB State	60 State	Drive	DB Pile	60 Pile	Obs'	#'s	Actual	Zone	Zone 2	Depth	Shore	Behav	Behav dir	Behav Dir 2	In line?	Grebes	Other Act	Rig
116	KK	Yes	1539	1542	After 1300	Flood	•	0.0	8	West	No	100	>50%	None	Standby	No	•	•	3	2	•	F90	Bow	•	380	Act mill	East	Lateral	No	•	•	DB Pac
110	KK	Yes	1540	1555	After 1300	Ebb	2.1	•	0	•	No	100	>50%	All	Standby	Yes	45	230	15	3	1000	F90	Bow	•	180	Act mill	North	Towards	Yes	•	•	DB Pac
114	KK	Yes	1544	1546	After 1300	Flood	•	0.0	8	West	No	80	>50%	None	None	No	•	•	2	2	•	F90	Bow	•	280	Act mill	West	Lateral	No	•	•	DB Pac
114	KK	Yes	1544	1546	After 1300	Flood	•	0.0	8	West	No	80	>50%	None	None	No	•	•	2	2	•	F90	Bow	•	280	Act mill	West	Lateral	No	•	•	DB Pac
116	KK	Yes	1545	1546	After 1300	Flood	•	0.0	8	West	No	100	>50%	None	Standby	No	•	•	1	1	•	SW	Side	•	380	Polar	South	Away	No	•	•	DB Pac
127	KK	No	1545	1546	After 1300	Flood	•	0.0	0	•	No	50	>50%	None	None	No	•	•	1	1	•	East 60	Side	6.096	74	Polar	West	Lateral	No	•	Misc	The 60
134	KK	No	1545	1547	After 1300	Flood	•	0.0	5	SE	No	100	>50%	None	None	No	•	•	2	1	•	NW	Side	•	400	Polar	South	Away	No	10	•	DB Pac
92	BF	Yes	1546	1548	After 1300	Ebb	0.3	0.0	•	•	No	0	<50%	Standby	Standby	Yes	•	150	2	2	•	F90	Bow	•	160	Act mill	South	Away	No	•	Shade	DB Pac
138	KK	Yes	1547	1548	After 1300	Ebb	1.3	0.1	8	West	No	80	>50%	Standby	Standby	Yes	370	230	1	1	•	B60	Stern	11.278	119	Pa mill	Stat/unknown	Stationary	No	•	•	The 60
120	KK	Yes	1549	1550	After 1300	Flood	-0.3	0.2	8	West	No	0	<50%	Standby	Standby	Yes	200	520	1	2	•	B90	Stern	•	240	Act mill	South	Away	No	•	•	DB Pac
127	KK	No	1557	1558	After 1300	Flood	•	0.0	0	•	No	40	<50%	None	None	No	•	•	1	1	•	NW	Side	•	260	Polar	South	Away	No	•	•	DB Pac
92	BF	Yes	1600	1601	After 1300	Ebb	0.3	0.0	•	•	No	0	<50%	Standby	Standby	Yes	•	150	1	1	•	F90	Bow	•	160	Pa mill	Stat/unknown	Stationary	No	•	•	DB Pac
127	KK	Yes	1600	1601	After 1300	Flood	•	0.0	0	•	No	40	<50%	None	None	No	•	•	1	1	•	F90	Bow	•	260	Act mill	East	Lateral	No	•	•	DB Pac
120	KK	Yes	1601	1617	After 1300	Flood	-0.3	0.2	8	West	No	0	<50%	All	All	Yes	25	480	16	2	•	F90	Bow	•	240	Act mill	North	Towards	Yes	•	•	DB Pac
92	BF	Yes	1605	1606	After 1300	Ebb	0.0	0.0	•	•	No	0	<50%	Standby	All	Yes	•	200	1	2	•	NW	Side	•	160	Polar	South	Away	No	•	•	DB Pac
127	KK	Yes	1612	1613	After 1300	Flood	•	0.0	0	•	No	40	<50%	None	None	No	•	•	1	1	•	SW	Side	•	260	Act mill	North	Towards	No	•	•	DB Pac
138	KK	No	1614	1619	After 1300	Ebb	1.1	0.1	8	West	No	70	>50%	Standby	Standby	Yes	410	130	5	2	•	B60	Stern	10.668	108	Act mill	East	Lateral	No	•	•	The 60

APPENDIX 2: SUMMARY GRAPHS OF STOMACH CONTENT ANALYSES FISH



AR010171