Moss Landing Power Plant
Units 1&2 and Units 6&7

Impingement Study Data Report

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Prepared for:
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1.0 INTRODUCTION

This report provides the results of a 12-month impingement study conducted at the Moss Landing Power Plant (MLPP) Units 1&2 and Units 6&7 intakes from November 9, 2005 through November 1, 2006. This study was conducted to fulfill the requirements of the Central Coast California Regional Water Quality Control Board (CCRWQCB). Results from the 2005–2006 impingement study will be combined with the results of an earlier (1999–2000) entrainment and source water study in the final Impingement Mortality and Entrainment (IM&E) report to be submitted at a later date. The IM&E report will fulfill the Clean Water Act Phase II Regulations, which were published by the U.S. Environmental Protection Agency on July 9, 2004.

1.1 Background

MLPP completed an entrainment study in 1999–2000 as part of the California Energy Commission's Application for Certification process for two proposed new combined-cycle units to be built on the existing facility and to fulfill the necessary National Pollutant Discharge Elimination System (NPDES) permitting process for the CCRWQCB. The entrainment study was designed and conducted under the direction of a Technical Working Group (TWG) comprised of members of the CCRWQCB, and its consultants, the California Energy Commission (CEC) and its consultant, California Department of Fish and Game (CDFG), and Duke Energy (MLPP's former owner) and its consultants. An entrainment report, the *Moss Landing Power Plant Modernization Project 316(b) Resource Assessment* was submitted on April 28, 2000 to the CCRWQCB and the CEC. The CEC approved the construction and operation of Units 1&2 and the CCRWQCB issued an NPDES permit for operation of the new units with funds for the Elkhorn Slough Foundation to restore Elkhorn Slough. The CCRWQCB, TWG, and MLPP agreed that once the intake for retired Units 1-5 was modified to supply cooling water to the new combined-cycle units (Units 1&2) and Units 1&2 began to operate, an impingement study would be conducted. Impingement surveys also were conducted at the Units 6&7 intake during the 2005–2006 study when Units 6&7 were operating.

1.2 Impingement Study Plan

The MLPP Impingement Study Plan was developed in 2005 by MLPP and Tenera Environmental. The Study Plan was designed to provide the biological information necessary to fulfill all pertinent 316(b) Phase II impingement mortality study requirements, and was based on recent impingement studies performed in California in recent years for CEC relicensing studies (such as those at the AES Huntington Beach, Duke Energy Morro Bay, and Duke Energy South Bay power plants), and 316(b) demonstrations (such as at the PG&E Diablo Canyon and NRG

Encina power plants). All of these studies were performed with input from technical working groups comprised of representatives from the project applicants, the California RWQCB, CDFG, National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife Service (USFWS), and consultants. The MLPP Impingement Study Plan was submitted to the CCRWQCB in October 2005, and is provided in Appendix A.

1.3 Organization of the Report

This report contains four sections and two Appendices. Section 2.0 provides a description of MLPP, Section 3.0 describes the methods used during the 2005–2006 impingement study, and Section 4.0 provides the results of the study. Appendix A contains the MLPP Impingement Study Plan and Appendix B provides data collected during each impingement survey.

2.0 DESCRIPTION OF THE MOSS LANDING POWER PLANT

This section describes Moss Landing Power Plant (MLPP). Section 2.1 describes Units 1&2 and Units 6&7 and their cooling water systems.

2.1 Moss Landing Power Plant

MLPP is located on the eastern shoreline of Moss Landing Harbor (Figure 2-1). This medium sized harbor, which provides dock space for approximately 600 commercial and recreational vessels, is located about 110 miles (177 km) south of San Francisco, California. Moss Landing Harbor is located roughly midway between Santa Cruz and Monterey, California and is open to Monterey Bay. The plant is located in a relatively undeveloped area that includes industrial facilities, agricultural lands, sparse residences, recreational beaches, and tidal wetlands.

MLPP has two separate intake structures in Moss Landing Harbor for withdrawal of cooling water that is necessary to remove excess heat from the power generation process (Figure 2-2). Units 1&2 are two 510-megawatt (MW) high efficiency combined-cycle (CC) generating units, and Units 6&7 are two natural gas fueled boiler units with the generating capacity of 754 MW and 755 MW, respectively (Table 2-1). Each combined-cycle unit consists of two advanced class combustion turbine generators, two heat recovery steam generators, and a single steam turbine generator. The combined-cycle units are capable of generating a total of about 1,020 MW while using about 250,000 gallons per minute (gpm) (946 m^3/min) of once-through ocean cooling water (at a maximum of 20°F [11.1°C] temperature increase). The daily maximum design cooling water and screen wash water flow for Units 1&2 and Units 6&7 is shown in Table 2-2. Two separate subsurface conduits carry the discharge from Units 6&7 to a submerged offshore discharge structure located in Monterey Bay about 2,400 feet from the plant, and approximately 600 feet offshore. The discharge from Units 1&2 is normally divided between the Unit 6 and Unit 7 discharge conduits, but can be directed in its entirety into either conduit.

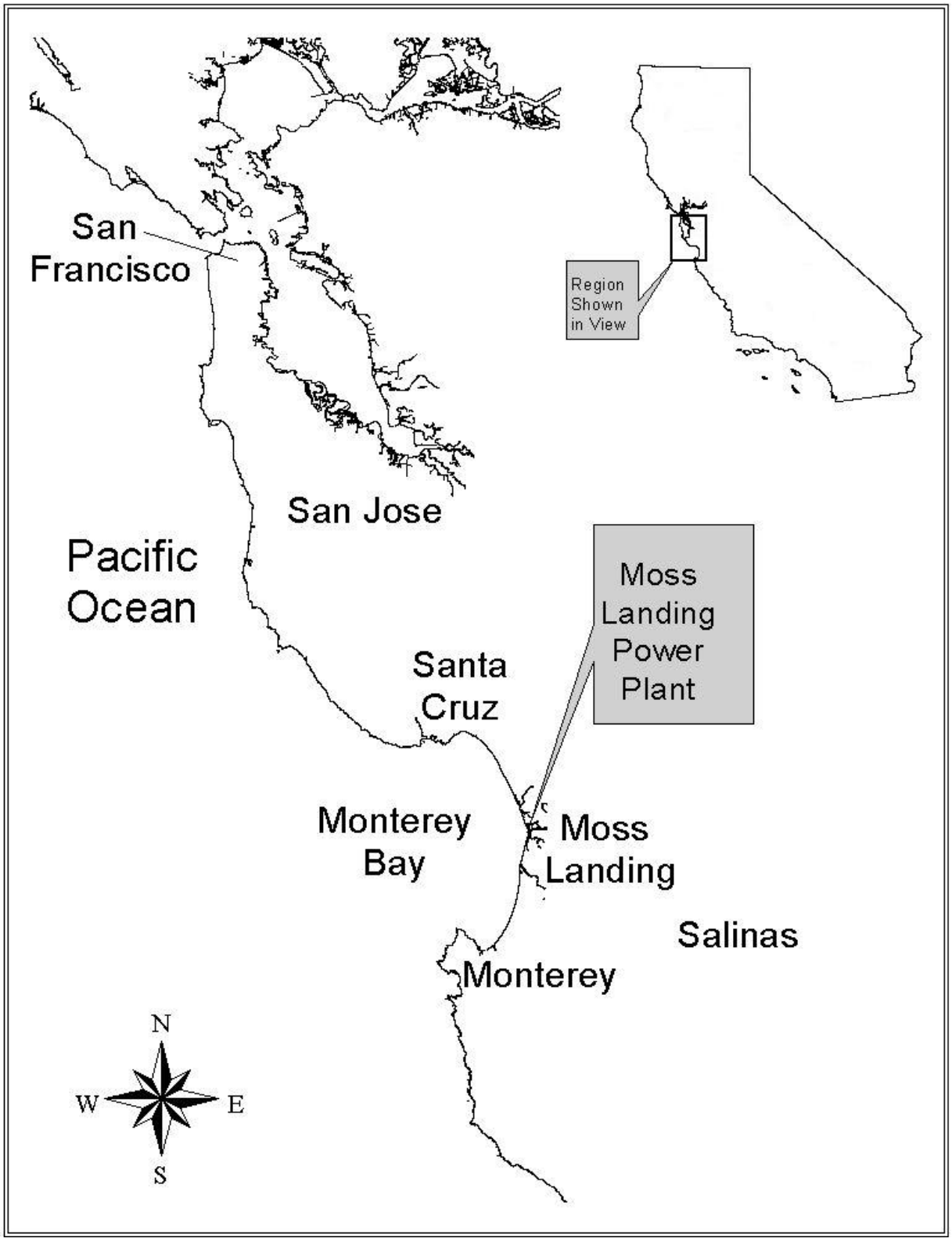


Figure 2-1. The location of Moss Landing Power Plant.

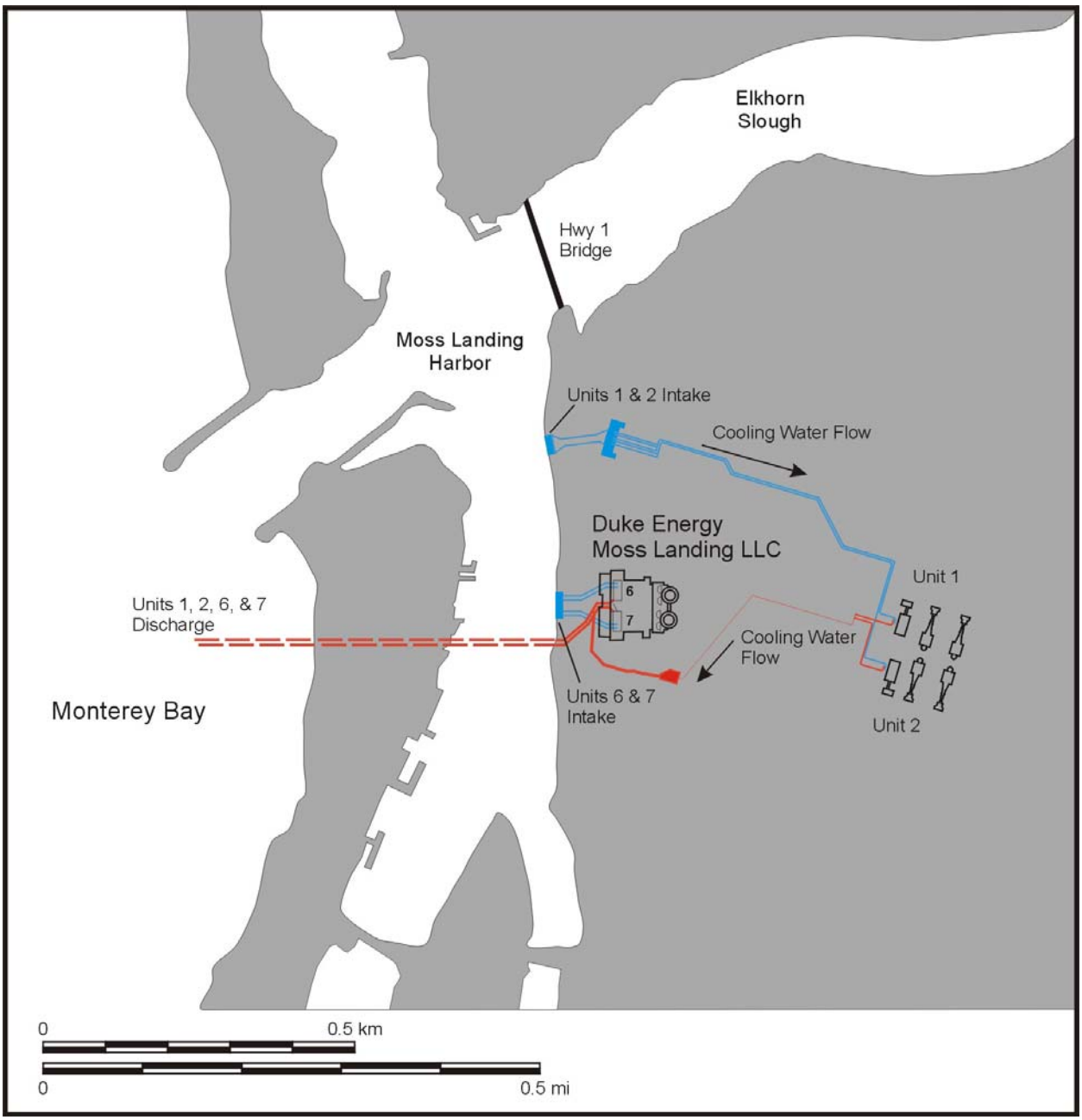


Figure 2-2. Map of the Moss Landing Power Plant showing locations of both intake structures, cooling water conduits, and discharge structure.

Table 2-1. Moss Landing Power Plant Units 1&2 and Units 6&7 generating capacity.

Unit	Megawatts
Unit 1	510
Unit 2	510
Total Units 1&2	1,020
Unit 6	754
Unit 7	755
Total Units 6&7	1,509
Plant total	**2,529**

Table 2-2. Moss Landing Power Plant Units 1&2 and Units 6&7 daily maximum design water flow.

Water Use	Daily Flow (mgd)	Daily Flow (m^3/day)
Unit 1 cooling water (3 pumps total)	180	681,300
Unit 2 cooling water (3 pumps total)	180	681,300
Units 1&2 screen wash water (3 pumps total)	0.1	2,460
Total Units 1&2	360.1	1,365,060
Unit 6 cooling water (2 pumps total)	432	1,635,120
Unit 7 cooling water (2 pumps total)	432	1,635,120
Units 6&7 screen wash water (3 pumps total)	1.15	2,460
Total Units 6&7	865.15	3,272,700
Plant total	**1,225.25**	**4,637,760**

Source: NPDES Permit No. CA 0006254.

2.1.1 Units 1&2

MLPP Units 1&2 are two 510-MW combined cycle generating units that began commercial operation in the Spring 2002. Each unit is cooled by three circulating water pumps (CWP), with a combined flow of 125,000 gpm. Cooling water is drawn from Moss Landing Harbor, entering the system through an intake structure located on the east side of the Harbor, about 500 feet south of the entrance to Elkhorn Slough (Figure 2-2). The concrete intake structure was originally built to serve the plant's former Units 1-5 that were constructed in the 1950s. Units 1-5 permanently ceased operation in 1995, and the intake was later modified to meet the debris filtration needs of the new Units 1&2. Water entering the system initially passes through a bank of vertical bar racks (Figure 2-3). The bars are positioned with approximately 4 inch center-to-center spacing, which provides 3½ inch wide openings between bars.

Figure 2-3. Units 1&2 intake bar racks.

The bar racks extend from the deck of the intake structure, 9.6 feet above mean lower low water (MLLW), down to the Harbor bottom at a depth of 20.4 feet below MLLW. Debris impinged on the bars is removed by an automated raking system (Figure 2-4) and deposited in a receptacle for subsequent disposal in a landfill.

During a November 2006 survey, water velocity immediately in front of the Units 1&2 bar racks ranged from 0.38 to 0.51 feet per second (fps) among the six intake bays, and averaged 0.46 fps over the entire intake (Tenera 2007).

Figure 2-4. Units 1&2 intake bar rack rake.

Located approximately 20 feet behind the bar racks are the traveling screens. The traveling screens remove most of the debris that is small enough to pass through the bar racks, but large enough to potentially clog the plant's condenser tubes. Each generating unit has a bank of three screens. Each of the screens is 10 feet wide and extends down to the floor of the intake structure, 20 feet below MLLW. When the traveling screens are in operation, cooling water passes through an upward rotating belt of stainless steel screen with an effective mesh size of 5/16 inch (Figure 2-5). The screen belt lifts debris out of the flow stream and carries it to the top of the traveling screen where a seawater screenwash system sprays the debris off the screen and onto a conveyor belt. The conveyor belt carries the debris to the same receptacle utilized by the bar rack rake system (Figure 2-6). The Units 1&2 traveling screens are inclined 35 degrees from vertical to enhance their ability to retain debris. This also reduces the through-screen velocity by presenting a larger screen area to the flow than would be presented by a vertical traveling screen. The traveling screens are normally operated (rotated) every four hours for a period of 20 to 30 minutes. They can also be activated automatically during periods of high debris loading if the differential water height between the upstream and downstream sides of the traveling screen exceeds a predetermined value due to clogging of the stationary screen. The traveling screens can also be run continuously, as a precaution, when debris levels are high. Water velocity in front of the traveling screens has not been measured directly, but has been calculated to be about 0.5 fps.

Figure 2-5. Units 1&2 traveling screens. Four of the six screens are shown.

Figure 2-6. Traveling screen debris conveyor system. Bar rack rake is in the background.

The circulating water pumps (CWP) that supply cooling water to Units 1&2 are located approximately 300 feet downstream of the traveling screens (Figure 2-7). Each generating unit has three CWP that provide a total cooling water flow of 125,000 gpm (180 mgd) to its steam condenser and other heat exchangers.

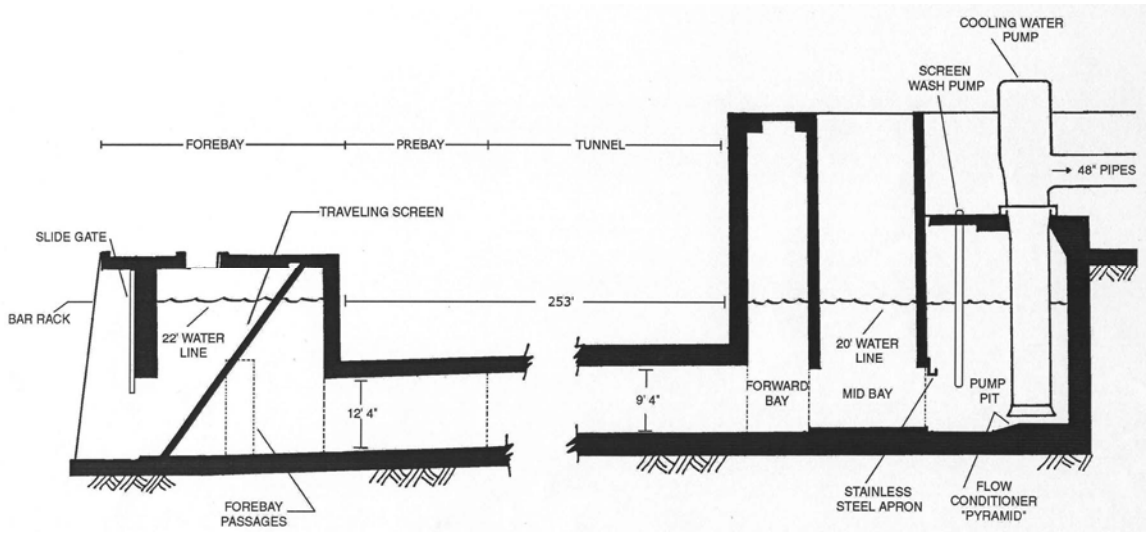


Figure 2-7. Cross-sectional diagram of the Units 1&2 intake structure and pumpbays.

Each of the three CWP discharge into individual 48-inch pipes which, after a run of about 200 feet, join together into a single 84-inch diameter pipe. The two 84-inch lines (one per unit) carry the cooling water a distance of about 2,000 feet to the Unit 1&2 condensers. Upon exiting the condensers, the two discharge lines feed into a single 120-inch discharge pipe that runs about 1,400 feet to the disengaging basin. The disengaging basin is a concrete reservoir, open to the atmosphere, where turbulent mixing aerates the discharge flow and provides some cooling. The basin also acts as a vacuum beaker and prevents siphoning of the discharge flow. The discharge exits the disengaging basin via two discharge conduits that run about 600 feet to a point just west of the Units 6&7 turbine building where they join the Unit 6 and Unit 7 discharge lines. Stop logs can be inserted at the disengaging basin to direct the Units 1&2 discharge into either the Unit 6 or Unit 7 flow streams or, as is normally the case, they can be removed to allow the flow to be split between the two conduits. The two discharge conduits carry the combined discharge of all four generating units about 2,400 feet from the plant to the discharge structure located approximately 600 feet offshore in Monterey Bay.

2.1.2 Units 6&7

The Units 6&7 intake structure is located on the east shore of Moss Landing Harbor about 700 feet south of the Units 1&2 intake structure (Figure 2-2). The structure has many of the same features found at the Units 1&2 intake, bar racks and traveling screens, but the layout is considerably different (Figure 2-8). The bar racks are located behind a vertical curtain wall that

extends down to about 3 feet below MLLW. The wall prevents large floating debris from being impinged on the bar racks. The spacing between bars is about 3 inches. Approach velocity in front of the bar racks was measured in November 2006; the average velocity across the entire intake was 0.80 fps.

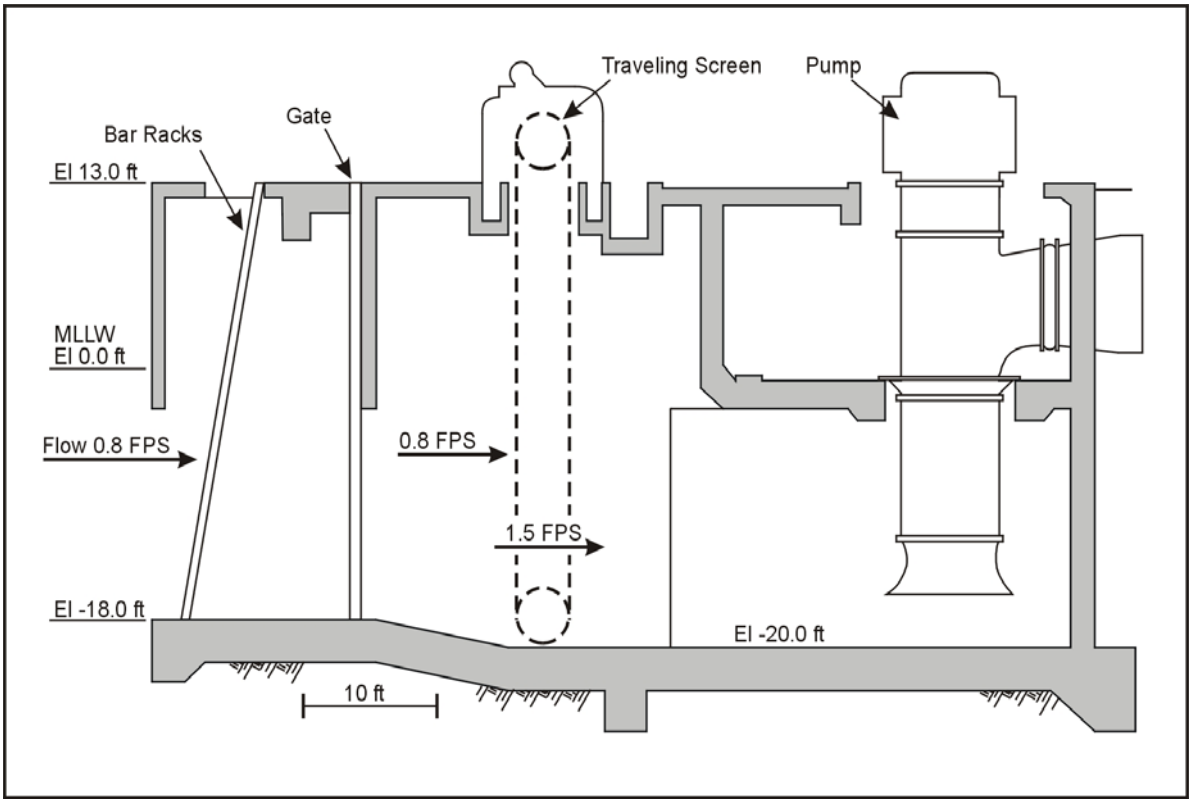


Figure 2-8. Cross-sectional diagram of the Units 6&7 intake structure.

Traveling screens are located about 25 feet downstream of the bar racks. These are vertical traveling screens with 3/8-inch screen mesh. Each generating unit has four 10-ft-wide traveling screens, two serving each of its CWP, that extend down to the floor of the intake structure (20 feet below MLLW). The screenwash system removes debris from the screens, and flushes it into a sluiceway that empties into a screenwash wet well. The screenwash discharge, less the impinged material, is returned to Monterey Bay by large-diameter screen refuse pumps that empty into the discharge conduits of Units 6&7 and overflow returning to Moss Landing Harbor. The impinged material that is retained in the wet well is periodically removed by a local refuse collection contractor and trucked to a sanitary landfill for disposal. Units 6&7 is not equipped with a bar rack cleaning system. Bar racks are cleaned periodically by divers generally only once or twice per year. Due to the limited operation of Units 6&7, the traveling screens are currently rotated and cleaned on an as-needed basis. They can also be activated automatically during periods of high debris loading if the differential water height between the upstream and downstream sides of the traveling screen exceeds a predetermined value due to clogging of the

stationary screen. The screens can also be run continuously, as a precaution, when debris levels are high. Water velocity at the traveling screens has not been measured in recent years but was calculated in the past to be 0.8 fps approaching the screens and 1.5 fps through the screens.

Both generating units have two CWP that each provide a nominal flow of 150,000 gpm (300,000 gpm (432 mgd) per unit). Unlike the Units 1&2 CWP, the Units 6&7 pumps are located immediately behind the traveling screens (about 30 feet) and about 400 to 450 feet upstream of the plant's condensers. Each CWP discharges into its own conduit. Each conduit supplies cooling water to half of a generating unit's condenser. Upon exiting the condenser, the cooling water from both condenser halves flows into a common discharge conduit. The discharge from Unit 6 remains separate from that of Unit 7. The discharge flow from Units 1&2 joins the Units 6&7 discharge about 100 feet downstream of the condensers. The flow from Units 1&2 can be directed in its entirety into either the Unit 6 or Unit 7 conduit, but is normally split between the two. The two separate subsurface discharge conduits carry the flow from each unit to a submerged offshore discharge structure located in Monterey Bay 2,400 feet from the plant, and approximately 600 feet offshore.

2.2 Literature Cited

Tenera Environmental. 2007. LS Power Moss Landing LLC. 2006 Hydrographic Survey and Intake Approach Velocity Monitoring. Tenera Report No. ESLO2006-076.1.

3.0 PURPOSE AND METHODS

3.1 Introduction

The two primary ways cooling water withdrawal can affect aquatic organisms are through impingement and entrainment. The power plant's two cooling water intake systems (CWIS) contain traveling screens that exclude debris and organisms from the system. Impingement occurs when organisms larger than the traveling screen mesh size are held against the screens. These impinged organisms are assumed to undergo 100 percent mortality for analysis purposes.

3.2 Study Purpose

The purpose of this study, conducted from November 9, 2005 through November 1, 2006, was to characterize the juvenile and adult fishes and selected macroinvertebrates (shrimps, crabs, sea urchins, squid, and octopus) impinged by the power plant's CWIS. The sampling program was designed to provide estimates of the abundance, taxonomic composition, diel periodicity, and seasonality of organisms impinged at MLPP. In particular, this study focused on the rates (i.e., number or biomass of organisms per m^3 water flowing per time into the plant) at which fishes and various species of macroinvertebrates are impinged. The impingement rate is subject to tidal and seasonal influences that vary on several temporal scales (e.g., hourly, daily, and monthly) while the rate of cooling water flow varies with power plant operations and can change at any time. Data collected from weekly surveys are provided in Appendix B.

The results from the 2005–2006 study are provided Section 4.0.

Fishes and selected macroinvertebrates impinged at the MLPP intakes were sampled to assess the potential population-level impacts of impingement by the existing CWIS. Corollary data on flow rates and cooling water volumes were recorded for the samples collected. This assessment will specifically address the following question: What is the composition and abundance of juvenile and adult fishes and selected macroinvertebrates impinged by MLPP?

3.3 Methods

3.3.1 Sample Collection

Organisms impinged in MLPP's CWIS were sampled during a 24-hour period (survey) one-day per week from November 9, 2005 through November 1, 2006. Each survey was divided into

approximately four 6-hour cycles. During periods of heavy debris loading, the traveling screens operate automatically due to a pressure differential between the upstream and downstream sides of the screens, caused by clogging from debris or they can be manually operated. Organisms collected during these non-scheduled screen washes were added to those collected during scheduled screen washes. In addition to identifying and enumerating the fishes and macroinvertebrates impinged, the operating status of the circulating water pumps and environmental data (weather conditions and tidal height) were recorded for each cycle. Hourly records of circulating water pump operation were supplied by MLPP for all weekly survey periods.

Before each weekly sampling effort, all of the traveling screens and the bar racks (if possible) were cleaned of all impinged debris and organisms. The sluiceways and collection baskets were cleaned before the start of each 24-hour survey. A vexar liner was added to the Units 6&7 collection basket during times when sampling occurred at the intake. The liner was made of ¼-inch mesh, which is smaller than the mesh size of the intake screens to ensure that all impinged organisms were collected.

During each 6-hr cycle, the traveling screens remained stationary for a period of approximately 5.5 hours then were rotated and washed for 30 minutes. Samples were collected by rinsing the impinged material from the Units 1&2 traveling screens onto a conveyer belt, which deposited the material into a collection receptacle. At the Units 6&7 intake, impinged material was rinsed from the traveling screens into vexar-lined collection baskets. The debris and organisms rinsed from each intake's (Units 1&2 and Units 6&7) traveling screens was kept separate and processed according to the procedures provided in the following section. Material removed by the Units 1&2 bar rack rakes also was collected and processed. Units 6&7 bar racks are located behind a vertical curtain wall and are cleaned manually by divers as needed generally only once or twice a year. During the 2005–2006 impingement study, Units 6&7 operated so infrequently that cleaning of the bar racks was not warranted. The operating status of each circulating water pump during each 6-hour cycle was recorded on the data sheet.

When Units 6&7 were operating, the sampling schedule at each of the two intakes (Units 1&2 and Units 6&7) was offset by one hour to allow screen wash and sample collection to occur at each set of screens separately. A summary of the sampling activities at each intake is provided in Table 3-1.

Table 3-1. Summary of Moss Landing Power Plant impingement survey dates by unit group.

Survey Number	Survey Date	Units 1&2 Intake Screens	Units 1&2 Bar Rack	Units 6&7 Intake Screens
1	11-09-05	X	X	
2	11-16-05	X	X	
3	11-22-05	X	X	
4	11-30-05	X	X	
5	12-07-05	X	X	
6	12-14-05	X	X	
7	12-21-05	X	X	
8	12-28-05	X	X	
9	01-04-06	X	X	
10	01-11-06	X	X	
11	01-19-06	X	X	
12	01-25-06	X	X	
13	02-01-06	X	X	
14	02-07-06	X	X	
15	02-15-06	X	X	
16	02-22-06	X	X	
17	03-01-06	X	X	
18	03-08-06	X	X	
19	03-15-06	X	X	
20	03-22-06	X	X	
21	03-29-06	X	X	
*	04-07-06	*	*	
22	04-12-06	X	X	
23	04-19-06	X	X	
24	04-24-06	X	X	X
25	05-02-06	**	**	X
26	05-10-06	X	X	X
27	05-17-06	X	X	
28	05-23-06	X	X	X
29	06-01-06	X	X	
30	06-07-06	X	X	
31	06-14-06	X	X	
32	06-21-06	X	X	X
33	06-28-06	X	X	X
34	07-06-06	X	X	X
35	07-12-06	X	X	X
36	07-19-06	X	X	X
37	07-26-06	X	X	X
38	08-02-06	X	X	X
39	08-09-06	X	X	X
40	08-16-06	X	X	X
41	08-23-06	X	X	X
42	08-30-06	X	X	
43	09-06-06	X	X	X
44	09-13-06	X	X	
45	09-20-06	X	X	
46	09-27-06	X	X	
47	10-04-06	X	X	
48	10-11-06	X	X	
49	10-18-06	X	X	
50	10-25-06	X	X	
51	11-01-06	X	X	

Note: *Sampling was cancelled on April 7, 2006 because the circulating water pumps for Units 1&2 and Units 6&7 were not operating. **Maintenance activities at the Units 1&2 intake precluded impingement sampling on May 2, 2006.

3.3.2 Sample Processing Criteria

All fishes and selected macroinvertebrates in each sample were identified and enumerated. Criteria were established *a priori* for the types of data to be collected from each taxonomic category (Table 3-2). Weights and lengths of bony fishes (teleosts) and sharks and rays (elasmobranchs) were recorded: standard length (SL) for bony fishes and total length (TL) for sharks and rays. Any fish fragments or mutilated fishes collected were identified, if possible, and counted, but no length or weight data were recorded. These data records were included in estimates of impingement losses in a manner similar to the method used to assign individual weights to batch-weighed organisms (i.e., an average individual weight from the concurrent survey data was applied to the fragments or to the individuals in the enumerated batches). Carapace width, carapace length, dorsal mantle length, maximum arm spread, and test diameter were measured for crabs, shrimps, squid, octopus, and sea urchins, respectively. All lengths were recorded to the nearest 0.1 mm and all weights to the nearest 0.1 g. The sex of sharks, rays, and crabs was recorded. The condition (alive, dead, or mutilated) of the organism was also recorded, as was the type and volume of the impinged debris. All data were recorded on data sheets, verified, and subsequently entered into a computer database (Microsoft Access™).

A quality control (QC) program was implemented to ensure the correct identification, enumeration, and collection of length and weight measurements for the organisms impinged. Senior Tenera staff provided initial and ongoing training of all personnel conducting the sampling. Impingement cycles were randomly chosen for onsite QC re-sort to verify that all the organisms were removed from the impinged material, and that all organisms were identified correctly. All data were rechecked immediately after each survey to ensure the accuracy of data recorded on the datasheets. Senior Tenera staff conducted rigorous QC for all aspects of the study on two occasions during the impingement study.

Table 3-2. Sample processing and data collection criteria for the MLPP impingement study.

Organism Type/Comments	Count	Length	Weight	Condition of Specimen	Sex
Elasmobranchs (sharks, skates, rays) Total length measured.	X	X	X	X	X
Teleosts (bony fishes) Standard length measured.	X	X	X	X	–
Decapod crabs Carapace width measured.	X	X	X	X	X
Shrimps Carapace length from tip of rostrum to posterior edge of carapace measured.	X	X	X	X	–
Cephalopod mollusks Squid: mantle length measured, Octopus: maximum arm spread measured.	X	X	X	X	–
Sea urchins Test diameter measured.	X	X	X	X	–

'X' = data collected for these organisms: – = data *not* collected for these organisms.

4.0 RESULTS

Fishes and selected macroinvertebrates impinged at the MLPP intakes were collected to assess the potential population-level impacts of impingement by the cooling water intake systems of Units 1&2 and Units 6&7. The results from the 2005–2006 study are provided in this section. For the Final MLPP Phase II Impingement Mortality and Entrainment (IM&E) Report, the numbers and weights of impinged fishes and selected macroinvertebrates from each survey will be expanded by flow volumes to estimate annual impingement.

4.1 Selection of Organisms for Analyses

The impinged fish and invertebrate taxa selected for analysis in this study were chosen on the basis of both numeric abundance and biomass. Abundance data were analyzed to determine the species that comprised the top 90 percent of impingement for each type of organism for each intake (Units 1&2 and Units 6&7). These were considered to be both representative of impingement losses and likely to contain species whose populations were potentially affected by those losses. These species lists were further refined to incorporate taxa that were both numerically abundant as well as impinged in high biomass. This process ensured that the organisms examined were those with the greatest potential to experience population-level effects due to impingement losses at MLPP.

4.2 Data Analyses

Impingement estimates for species and taxonomic groups were obtained by first calculating cooling water flow during each screen wash cycle sampled during the 24-hour survey. The total time for each screen wash cycle was multiplied by the circulating water pump flow rates for either Units 1&2 combined (946 m^3pm [250,000 gpm] maximum) or Units 6&7 combined (2,271 m^3pm [600,000 gpm] maximum) as appropriate. Flow rate was then adjusted for each unit group based on the number of pumps operating during the 6-hour sampling cycles. For example, if only two of Units 6&7's four pumps were operating, the total flow rate would be reduced by half. The same would be true if only three of the six Units 1&2 pumps were in service. The flows from each cycle were used in calculating an impingement rate for each unit group (Units 1&2 or Units 6&7) based on the total number of organisms for a species or taxonomic group collected during the cycle. The average impingement rate for the day was calculated from the estimates from the cycles and multiplied by the total flow for the entire 24-hour collection period to estimate total impingement for the day.

Subsampling was used to contend with any large influx of a single taxon. When a large number of individuals from a single taxon were collected during a cycle, the first 50 were measured and weighed while the remainder were counted and batch-weighed. For these taxa, weights and counts for the measured individuals were totaled and then an average weight per individual was calculated. This unit weight per individual was multiplied by the total count (including the individuals that were not weighed) to obtain an estimate of the total weight for each cycle. The counts and weights were then totaled for each 24-hour collection period.

4.3 Overview of Results for Fishes

Data provided in this section are from weekly 24-hour impingement collections beginning November 9, 2005 and continuing through November 1, 2006. A total of 50 surveys were conducted at the Units 1&2 intake during the 12-month study (see Table 3-1). Impingement surveys were conducted at Units 6&7 intake when circulating water pumps were operating; 15 surveys were conducted from November 9, 2005 through November 1, 2006 (see Table 3-1). Appendix B provides results of each impingement survey.

4.3.1 Units 1&2

A total of 8,560 fishes were collected from the Units 1&2 traveling screens and bar racks; 8,527 from the traveling screens and 33 from the bar racks. Sixty-three fish taxa were collected from Units 1&2 traveling screens and 12 fish taxa collected from the Units 1&2 bar racks (Table 4-1).

Eight taxa or species comprised 91.1 percent of the total number of fishes impinged at the Units 1&2 traveling screens (Figure 4-1). Silversides Atherinopsidae were the most abundantly impinged fish taxa (n=2,651), comprising 31.1 percent of the total number of fishes impinged. Members of the silverside family included topsmelt *Atherinops affinis*, jacksmelt *Atherinopsis californiensis,* California grunion *Leuresthes tenuis* and individuals that could not be identified below the family level. Plainfin midshipman *Porichthys notatus* was the second most abundantly impinged fish comprising 15.9 percent of the total number of fishes impinged at the Units 1&2 traveling screens followed by pipefishes *Syngnathus* spp. (11.4 percent), northern anchovy *Engraulis mordax* (9.6 percent), sanddabs *Citharichthys* spp. (9.3 percent), arrow goby *Clevelandia ios* (8.1 percent), threespine stickleback *Gastererosteus aculeatus* (3.1 percent), and bay goby *Lepidogobius lepidus* (2.5 percent). Sanddabs included speckled sanddab *Citharichthys stigmaeus* and sanddabs that could not be identified to species.

The total weight of fishes impinged on the traveling screens and bar racks was 40.5 kg (89 lb) and 3.7 kg (8 lb), respectively (Table 4-1). Thirteen taxa or species comprised 84.4 percent of the total biomass impinged at the Units 1&2 traveling screens. Silversides accounted for the highest biomass (33.3 percent), followed by northern anchovy (9.9 percent), Pacific staghorn sculpin (7.8 percent), plainfin midshipman (6.4 percent), cabezon *Scorpaenichthys marmoratus* (6.0 percent), Pacific electric ray *Torpedo californica* (5.6 percent), pipefishes (4.3 percent), bay goby (3.0 percent), starry flounder *Platichthys stellatus* (2.2 percent), sanddabs (2.2 percent), California tonguefish *Symphurus atricauda* (2.0 percent), and arrow goby (1.9 percent). On two occasions, large individual fish contributed to greater than 1 percent of the total biomass collected on the Units 1&2 traveling screens: green sturgeon *Acipenser medirostris* (1.9 percent), ratfish *Hydrolagus colliei* (1.5 percent).

One species that is now afforded protection under the Endangered Species Act was collected at the Units 1&2 intake during the year-long impingement study. The southern distinct population segment (DPS) of the North American green sturgeon was listed by the National Marine Fisheries Service (NMFS) as a threatened species on July 7, 2006. The green sturgeon (546 mm standard length [SL] [21.5 in.]) was collected during the January 4, 2006 survey before the species was listed.

One Chinook salmon *Oncorhynchus tshawytscha* (122 mm SL [4.8 in.]) was collected during the August 16, 2006 survey. This specimen was examined by NMFS in Santa Cruz and it was determined that it was a hatchery-raised fish that was released in Moss Landing Harbor as part of a re-stocking program.

4.3.2 Units 6&7

A total of 20,720 fishes were collected from the Units 6&7 traveling screens (Table 4-1). Fifty-three fish taxa were collected from Units 6&7 traveling screens. Five taxa or species comprised 90.8 percent of the total number of fishes impinged at Units 6&7 (Figure 4-2). Northern anchovy were the most abundantly impinged fish taxa (n=16,462), comprising 79.4 percent of the total number of fishes impinged at the Units 6&7 intake. Silversides were the second most abundant fish impinged, comprising 5.5 percent of the total number of fishes impinged. Members of the silverside family impinged at the Units 6&7 intake included topsmelt, jacksmelt, and individuals that could not be identified below the family level. Sanddabs comprised 2.4 percent of the total number of fishes impinged, followed by shiner surfperch *Cymatogaster aggregata* (1.8 percent), and Pacific staghorn sculpin *Leptocottus armatus* (1.7 percent).

Nine taxa or species comprised 90.1 percent of the total biomass impinged at the Units 6&7 traveling screens (Figure 4-2). Northern anchovy accounted for the highest biomass

(53.8 percent), followed by thornback *Platyrhinoides triseriata* (9.4 percent), Pacific electric ray (7.0 percent), silversides (5.6 percent), sablefish *Anoplopoma fimbria* (4.3 percent, n=5), Pacific staghorn sculpin (3.3 percent), plainfin midshipman (2.5 percent), sanddabs (2.3 percent), and English sole *Parophrys vetulus* (1.9 percent).

Five Chinook salmon were collected at the Units 6&7 intake during the 2005–2006 impingement study (Table 4-1). Two were collected during the July 6, 2006 survey (both fish measured 89 mm SL [3.5 in.]), one was collected during the July 12, 2006 survey (100 mm SL [3.9 in.]), and two were collected during the August 2, 2006 survey (111 and 113 mm SL [approximately 4.4 in.]) (Appendix B). These specimens were also examined by NMFS in Santa Cruz and it was determined that they, like the specimen impinged at Units 1&2, were hatchery-raised fish that were released in Moss Landing Harbor as part of a re-stocking program.

Table 4-1. Numbers and weights of fishes and selected macroinvertebrates collected during the 2005–2006 MLPP impingement study.

Taxon	Common Name	Total Count	Units 1&2 Count	Units 1&2 Weight* (g)	Units 1&2 Weight (lb)	Units 1&2 Bar Rack Count	Units 1&2 Bar Rack Weight* (g)	Units 1&2 Bar Rack Weight (lb)	Units 6&7 Count	Units 6&7 Weight* (g)	Units 6&7 Weight (lb)
FISHES											
Engraulis mordax	northern anchovy	**17,280**	818	3,993.45	8.81	-	-	-	16,462	77,804.04	171.56
Atherinopsidae unid.	silversides	**3,782**	2,651	13,497.98	29.76	1	37.20	0.08	1,130	8,099.87	17.86
Porichthys notatus	plainfin midshipman	**1,635**	1,358	2,597.38	5.73	1	33.60	0.07	276	3,625.10	7.99
Citharichthys spp.	sanddabs	**1,279**	792	878.37	1.94	-	-	-	487	3,352.58	7.39
Syngnathus spp.	pipefishes	**1,065**	973	1,754.32	3.87	4	5.20	0.01	88	185.31	0.41
Clevelandia ios	arrow goby	**701**	693	752.99	1.66	3	1.20	0.00	5	16.40	0.04
Leptocottus armatus	Pacific staghorn sculpin	**556**	196	3,160.77	6.97	-	-	-	360	4,834.82	10.66
Gasterosteus aculeatus	threespine stickleback	**455**	268	172.98	0.38	1	0.20	0.00	186	433.39	0.96
Cymatogaster aggregata	shiner surfperch	**439**	57	701.54	1.55	1	2.60	0.01	381	2,603.60	5.74
Lepidogobius lepidus	bay goby	**352**	212	1,195.90	2.64	-	-	-	140	933.90	2.06
Clupea pallasii	Pacific herring	**347**	5	58.50	0.13	-	-	-	342	1,782.44	3.93
Parophrys vetulus	English sole	**298**	20	200.71	0.44	-	-	-	278	2,775.38	6.12
Symphurus atricauda	California tonguefish	**162**	112	830.58	1.83	-	-	-	50	319.27	0.70
Phanerodon furcatus	white surfperch	**147**	19	248.12	0.55	-	-	-	128	830.59	1.83
Scorpaenichthys marmoratus	cabezon	**115**	72	2,431.40	5.36	17	223.60	0.49	26	1,093.50	2.41
Platichthys stellatus	starry flounder	**91**	22	878.80	1.94	1	1.60	0.00	68	1,445.50	3.19
Sardinops sagax	Pacific sardine	**66**	18	229.98	0.51	-	-	-	48	560.53	1.24
Spirinchus starksi	night smelt	**61**	4	33.80	0.07	-	-	-	57	474.22	1.05
Torpedo californica	Pacific electric ray	**48**	12	2,252.40	4.97	-	-	-	36	10,107.50	22.29
Artedius spp.	sculpins	**42**	38	522.70	1.15	-	-	-	4	23.30	0.05
Hyperprosopon argenteum	walleye surfperch	**37**	1	0.00	0.00	-	-	-	36	141.80	0.31
Acanthogobius flavimanus	yellowfin goby	**25**	23	537.31	1.18	-	-	-	2	16.90	0.04
unidentified fish, damaged	unid. damaged fish	**21**	8	28.80	0.06	-	-	-	13	10.40	0.02
Gobiidae unid.	gobies	**21**	21	3.14	0.01	-	-	-	-	-	-
Peprilus simillimus	Pacific butterfish	**19**	-	-	-	-	-	-	19	145.50	0.32
Rhinogobiops nicholsi	blackeye goby	**17**	17	34.20	0.08	-	-	-	-	-	-
Embiotocidae unid. (juv.)	juv. surfperches unid.	**15**	1	0.50	0.00	-	-	-	14	34.10	0.08
Rimicola spp.	kelp clingfishes	**14**	12	3.89	0.01	-	-	-	2	1.80	0.00
Pimephalas promelas	fathead minnow	**13**	11	4.99	0.01	1	0.50	0.00	1	0.40	0.00
Artedius harringtoni	scalyhead sculpin	**13**	11	97.60	0.22	-	-	-	2	18.80	0.04
Platyrhinoidis triseriata	thornback	**12**	2	12.70	0.03	-	-	-	10	13,610.60	30.01
Hyperprosopon ellipticum	silver surfperch	**10**	-	-	-	-	-	-	10	20.40	0.04
Trachurus symmetricus	jack mackerel	**8**	-	-	-	-	-	-	8	35.40	0.08
Sebastes auriculatus	brown rockfish	**8**	5	53.80	0.12	-	-	-	3	74.20	0.16
Artedius lateralis	smoothhead sculpin	**8**	7	82.90	0.18	-	-	-	1	1.30	0.00
Myliobatis californica	bat ray	**7**	1	284.30	0.63	1	3,400.00	7.50	5	2,150.50	4.74
Gibbonsia spp.	clinid kelpfishes	**7**	6	58.90	0.13	-	-	-	1	27.20	0.06
Oncorhynchus tshawytscha	Chinook salmon	**6**	1	21.00	0.05	-	-	-	5	52.75	0.12

*Organisms that were not weighed because they were mutilated were assigned an average weight calculated from weights collected for that species.

Table 4-1 continued. Numbers and weights of fishes and selected macroinvertebrates collected during the 2005–2006 MLPP impingement study.

Taxon	Common Name	Total Count	Units 1&2 Count	Units 1&2 Weight* (g)	Units 1&2 Weight (lb)	Units 1&2 Bar Rack Count	Units 1&2 Bar Rack Weight (g)	Units 1&2 Bar Rack Weight (lb)	Units 6&7 Count	Units 6&7 Weight (g)	Units 6&7 Weight (lb)
FISHES (continued)											
Odontopyxis trispinosa	pygmy poacher	**6**	6	11.80	0.03	-	-	-	-	-	-
Neoclinus uninotatus	onespot fringehead	**6**	6	63.60	0.14	-	-	-	-	-	-
Chilara taylori	spotted cusk-eel	**6**	4	77.50	0.17	-	-	-	2	80.50	0.18
Pleuronichthys verticalis	hornyhead turbot	**5**	5	37.00	0.08	-	-	-	-	-	-
Phanerodon atripes	sharpnose seaperch	**5**	-	-	-	-	-	-	5	25.20	0.06
Cyprinidae unid.	minnows and carps	**5**	2	3.20	0.01	-	-	-	3	1.95	0.00
Cottus asper	prickly sculpin	**5**	2	22.20	0.05	-	-	-	3	106.50	0.23
Cebidichthys violaceus	monkeyface eel	**5**	4	502.50	1.11	-	-	-	1	17.00	0.04
Anoplopoma fimbria	sablefish	**5**	-	-	-	-	-	-	5	6,250.00	13.78
Micrometrus minimus	dwarf surfperch	**4**	2	11.00	0.02	-	-	-	2	28.50	0.06
Embiotocidae unid.	surfperches	**4**	-	-	-	-	-	-	4	4.00	0.01
Scomber japonicus	Pacific mackerel	**3**	1	147.40	0.33	-	-	-	2	203.40	0.45
Diaphus theta	California headlight fish	**3**	3	9.60	0.02	-	-	-	-	-	-
Sebastes spp.	rockfishes	**2**	2	3.30	0.01	-	-	-	-	-	-
Ruscarius creaseri	roughcheek sculpin	**2**	2	3.80	0.01	-	-	-	-	-	-
Paralichthys californicus	California halibut	**2**	2	5.10	0.01	-	-	-	-	-	-
Myctophidae unid.	lanternfishes	**2**	2	4.60	0.01	-	-	-	-	-	-
Hypsoblennius gilberti	rockpool blenny	**2**	2	2.30	0.01	-	-	-	-	-	-
Aulorhynchus flavidus	tubesnout	**2**	2	3.00	0.01	-	-	-	-	-	-
Ammodytes hexapterus	Pacific sand lance	**2**	1	3.80	0.01	-	-	-	1	1.50	0.00
Stenobrachius leucopsarus	northern lampfish	**1**	-	-	-	-	-	-	1	4.50	0.01
Squalus acanthias	spiny dogfish shark	**1**	-	-	-	-	-	-	1	43.00	0.09
Sebastes paucispinis	bocaccio	**1**	-	-	-	-	-	-	1	3.70	0.01
Pholis ornata	saddleback gunnel	**1**	-	-	-	1	2.30	0.01	-	-	-
Parmaturus xaniurus	filetail cat shark	**1**	1	318.40	0.70	-	-	-	-	-	-
Orthonopias triacis	snubnose sculpin	**1**	1	3.50	0.01	-	-	-	-	-	-
Micrometrus aurora	reef perch	**1**	-	-	-	-	-	-	1	1.20	0.00
Liparis spp.	snailfishes	**1**	1	0.40	0.00	-	-	-	-	-	-
Icichthys lockingtoni	medusa fish	**1**	-	-	-	-	-	-	1	0.40	0.00
Hypsopsetta guttulata	diamond turbot	**1**	1	2.40	0.01	-	-	-	-	-	-
Hypomesus paetiosus	surf smelt	**1**	-	-	-	-	-	-	1	19.00	0.04
Hyperprosopon anale	spotfin surfperch	**1**	-	-	-	-	-	-	1	21.20	0.05
Hydrolagus colliei	ratfish	**1**	1	600.00	1.32	-	-	-	-	-	-
Heterostichus rostratus	giant kelpfish	**1**	1	7.20	0.02	-	-	-	-	-	-
Gillichthys mirabilis	longjaw mudsucker	**1**	-	-	-	-	-	-	1	31.70	0.07
Cyprinus carpio	common carp	**1**	1	1.10	0.00	-	-	-	-	-	-
Cottidae unid.	sculpins	**1**	-	-	-	1	0.40	0.00	-	-	-
Carassius auratus	goldfish	**1**	1	1.10	0.00	-	-	-	-	-	-

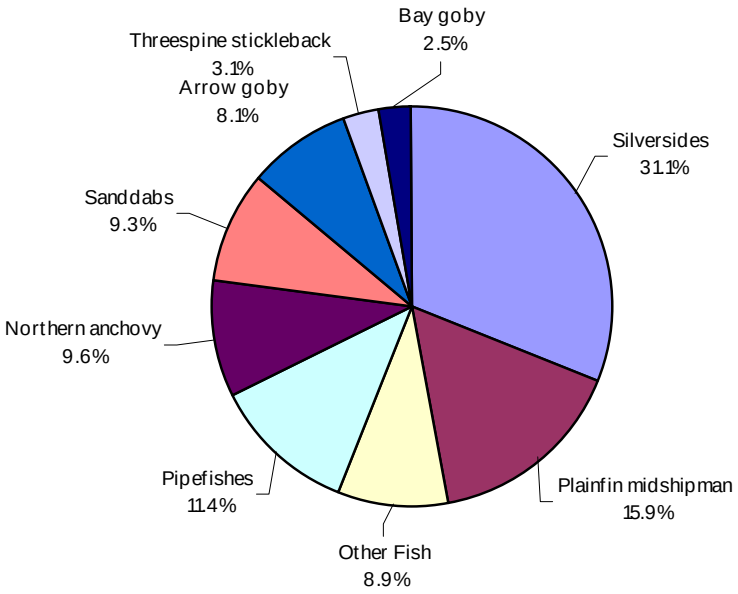
* Organisms that were not weighed because they were mutilated were assigned an average weight calculated from weights collected for that species.

Table 4-1 continued. Numbers and weights of fishes and selected macroinvertebrates collected during the 2005–2006 MLPP impingement study.

Taxon	Common Name	Total Count	Units 1&2 Count	Units 1&2 Weight* (g)	Units 1&2 Weight (lb)	Units 1&2 Bar Rack Count	Units 1&2 Bar Rack Weight (g)	Units 1&2 Bar Rack Weight (lb)	Units 6&7 Count	Units 6&7 Weight (g)	Units 6&7 Weight (lb)
FISHES (continued)											
Apodichthys flavidus	penpoint gunnel	**1**	1	6.30	0.01	-	-	-	-	-	-
Amphistichus argenteus	barred surfperch	**1**	1	308.50	0.68	-	-	-	-	-	-
Agonidae unid.	poachers	**1**	1	0.70	0.00	-	-	-	-	-	-
Acipenser mediros	green sturgeon	**1**	1	750.00	1.65	-	-	-	-	-	-
	Total Fishes:	**29,280**	**8,527**	**40,528**	**89**	**33**	**3,708**	**8**	**20,720**	**144,487**	**319**
INVERTEBRATES											
Crangon spp.	bay shrimp	**18,629**	14,095	17,090.28	37.68	14	12.41	0.03	4,520	5,698.78	12.57
Cancer spp.	Cancer crab	**1,029**	798	14,373.13	31.69	44	1,374.29	3.03	187	10,660.63	23.51
Pugettia spp.	kelp crabs	**660**	368	3,194.98	7.04	128	1,041.04	2.30	164	2,764.69	6.10
Heptacarpus spp.	tidepool shrimps	**568**	514	235.29	0.52	2	3.40	0.01	52	29.97	0.07
Pachygrapsus crassipes	striped shore crab	**322**	290	1,259.62	2.78	5	30.60	0.07	27	177.60	0.39
Hemigrapsus oregonensis	yellow shore crab	**86**	58	111.79	0.25	9	25.50	0.06	19	84.70	0.19
Emerita analoga	mole crab	**86**	82	133.30	0.29	-	-	-	4	11.80	0.03
Loligo opalescens	market squid	**53**	32	602.51	1.33	-	-	-	21	95.67	0.21
Pandalus spp.	unidentified shrimp	**23**	20	114.70	0.25	-	-	-	3	13.20	0.03
Blepharipoda occidentalis	spiny mole crab	**20**	20	126.10	0.28	-	-	-	-	-	-
Neotrypaea californiensis	ghost bay shrimp	**17**	15	41.80	0.09	-	-	-	2	4.90	0.01
Lophopanopeus spp.	black-clawed crabs	**16**	10	20.40	0.04	1	1.20	0.00	5	6.80	0.01
Grapsidae unid.	shore crabs	**12**	10	2.55	0.01	-	-	-	2	3.80	0.01
Pachycheles spp.	porcelain crabs	**8**	8	9.26	0.02	-	-	-	-	-	-
Octopus spp.	octopus	**8**	6	645.40	1.42	-	-	-	2	290.30	0.64
Pandalopsis dispar	sidestriped shrimp	**5**	-	-	-	-	-	-	5	49.30	0.11
Panulirus interruptus	California spiny lobster	**4**	4	0.22	0.00	-	-	-	-	-	-
Chionoecetes tanneri	grooved tanner crab	**4**	1	300.00	0.66	3	1,191.80	2.63	-	-	-
Upogebia pugettensis	blue mud shrimp	**3**	3	9.30	0.02	-	-	-	-	-	-
Scyra acutifrons	sharp-nosed crab	**3**	3	12.20	0.03	-	-	-	-	-	-
Pelia tumida	dwarf teardrop crab	**3**	3	1.19	0.00	-	-	-	-	-	-
Hemigrapsus nudus	purple shore crab	**3**	2	29.40	0.06	1	8.60	0.02	-	-	-
Penaeus californiensis	brown shrimp	**2**	2	79.60	0.18	-	-	-	-	-	-
Loxorhynchus crispatus	moss crab	**2**	2	79.50	0.18	-	-	-	-	-	-
Spirontocaris spp.	broken-back shrimp	**1**	1	0.80	0.00	-	-	-	-	-	-
Petrolisthes spp.	porcelain crabs	**1**	1	1.10	0.00	-	-	-	-	-	-
Panulirus interruptus (puerulus stage)	California spiny lobster	**1**	1	0.10	0.00	-	-	-	-	-	-
Heptacarpus stimpsoni	Stimpson's shrimp	**1**	1	0.30	0.00	-	-	-	-	-	-
Caridean unid.	unidentified shrimp	**1**	1	0.00	0.00	-	-	-	-	-	-
Carcinus maenas	European green crab	**1**	-	-	-	-	-	-	1	88.90	0.20
Callianassa californiensis	ghost shrimp	**1**	1	5.30	0.01	-	-	-	-	-	-
	Total Invertebrates:	**21,573**	**16,352**	**38,480**	**85**	**207**	**3,689**	**8**	**5,014**	**19,981.04**	**44**

* Organisms that were not weighed because they were mutilated were assigned an average weight calculated from weights collected for that species.

a) Units 1&2 Count



b) Units 1&2 Biomass

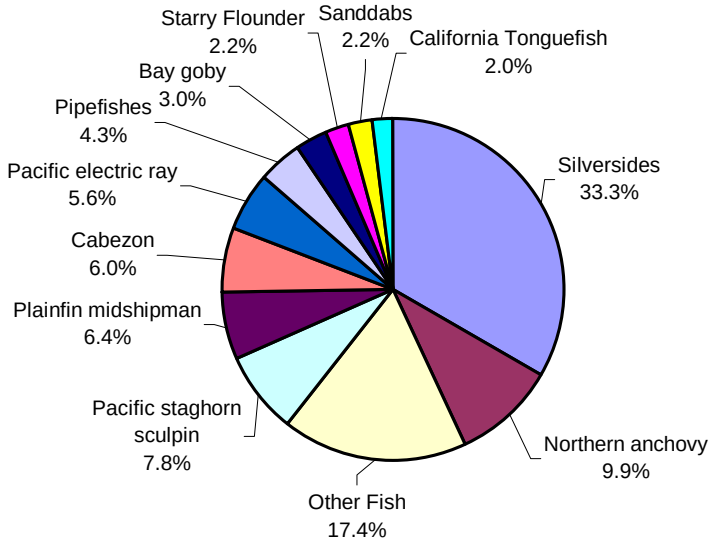
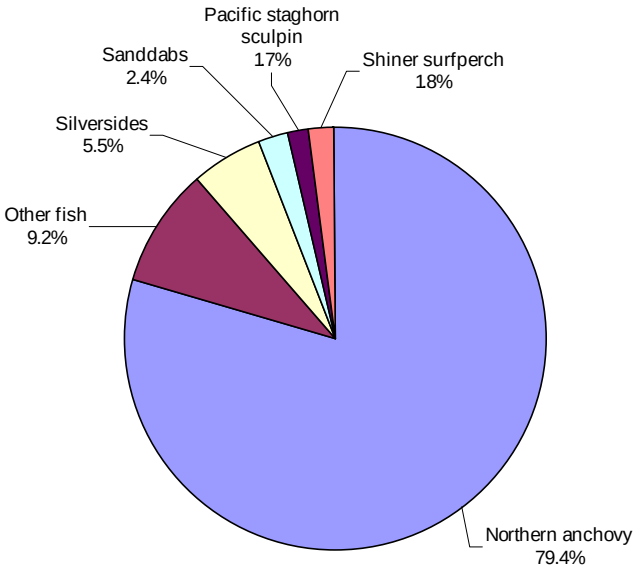


Figure 4-1. Percent taxonomic composition of fishes impinged at the Moss Landing Power Plant Units 1&2 traveling screens determined by a) total number impinged and b) biomass impinged (g).

a) Units 6&7 Count



b) Units 6&7 Biomass

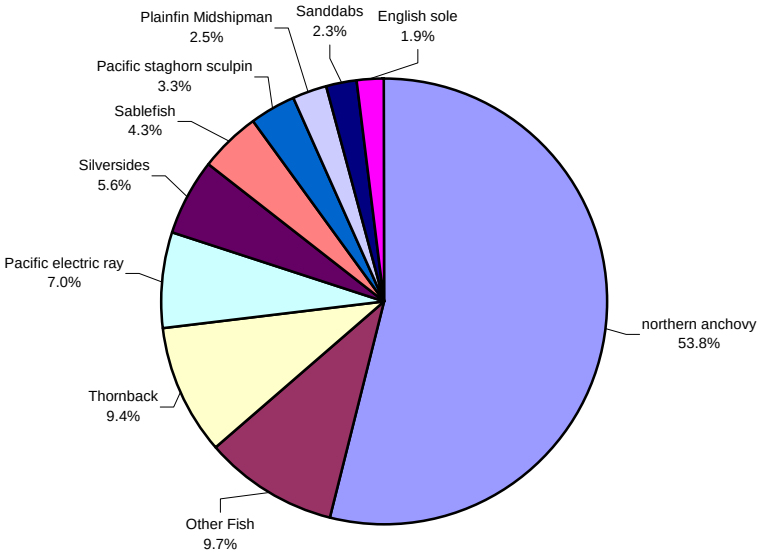


Figure 4-2. Percent taxonomic composition of fishes impinged at the Moss Landing Power Plant Units 6&7 traveling screens determined by a) total number impinged and b) biomass impinged (g).

Note: Percent composition for biomass does not total 100 due to rounding.

4.4 Fish Species Impinged

The following sections provide data regarding the top 90 percent of fishes impinged at both Units 1&2 and Units 6&7 traveling screens. The summaries provided below were organized based on the sampled abundance of the taxa/species collected at the Units 1&2 traveling screens since more surveys (n=50) were conducted at Units 1&2 than at Units 6&7 (n=15 surveys).

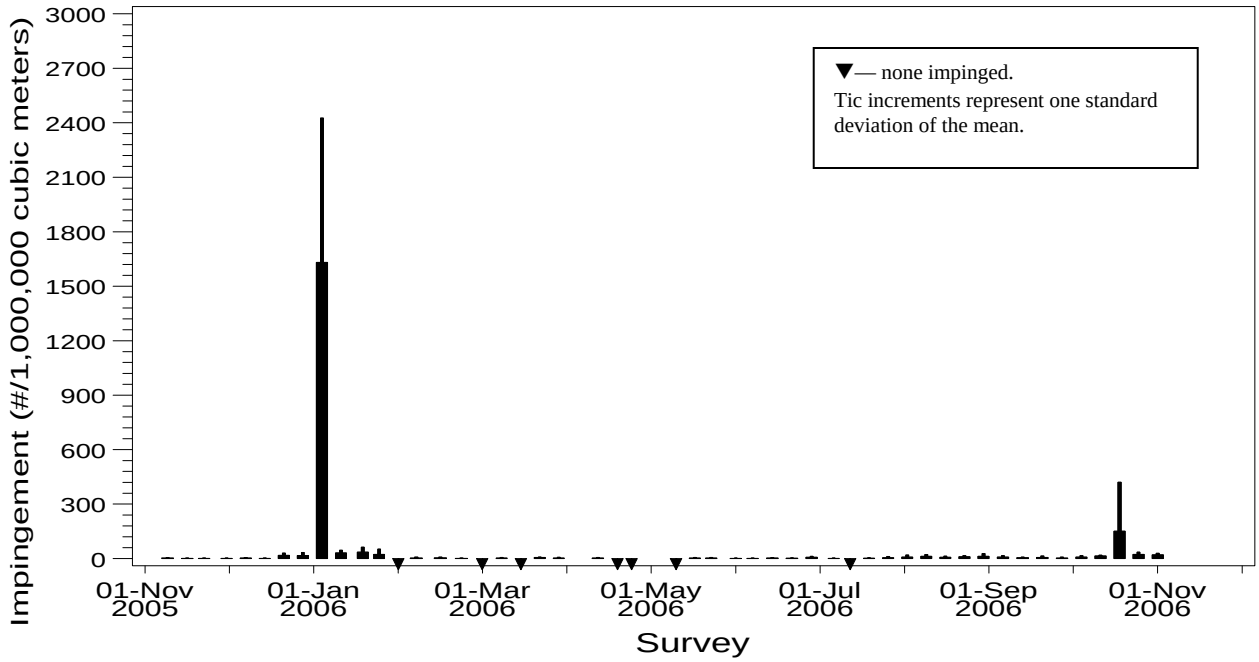
4.4.1 Silversides Atherinopsidae spp.

Silversides comprised 31.1 percent of the total number of fishes impinged at the Units 1&2 traveling screens during the November 1, 2005–November 9, 2006 MLPP impingement study (Figure 4-1). A total of 2,651 silversides weighing 13.5 kg (29.7 lb) were collected at the Units 1&2 traveling screens (Table 4-1). The silverside group was comprised of three species: topsmelt, California grunion, jacksmelt, and silversides that could not be identified to species. The majority of the silversides (over 99 percent) were topsmelt. Silversides were the most common fish collected at Units 1&2 both by number of individuals and biomass. Silversides were collected during 43 of the 50 surveys conducted (Figure 4-3). Approximately 78 percent (2,069 individuals) of the silversides impinged at Units 1&2 were collected during a single survey on January 4, 2006 (Appendix B). The fish from this survey also comprised the majority of the biomass (grams of fish) impinged during the study period. A single silverside was collected from the Units 1&2 bar racks.

Silversides comprised 5.6 percent of the total number of fishes impinged at the Units 6&7 traveling screens during the November 1, 2005–November 9, 2006 MLPP impingement study (Figure 4-2). A total of 1,130 silversides weighing 8.1 kg (17.9 lb) were collected at Units 6&7 during the impingement study at MLPP (Table 4-1). This group of silversides was comprised of topsmelt, jacksmelt, and silversides that could not be identified to species; no California grunion were collected at Units 6&7. Silversides were collected during all 15 surveys conducted at Units 6&7 (Figure 4-4). Approximately 89 percent (1,004 individuals) of total number of silversides were collected during four consecutive surveys at Units 6&7 in August 2006.

Length data are provided for topsmelt because they comprised the majority of silversides collected. A total of 540 topsmelt were measured from impingement collections at the Units 1&2 traveling screens (Table 4-1). Topsmelt ranged in length from 32 to 157 mm SL (0.8 to 6.2 in.) with a mean length of 76.1 mm SL (3.0 in.) (Figure 4-5 a). A total of 521 topsmelt were measured from the Units 6&7 collections during the study (Figure 4-5b). Topsmelt ranged in length from 47 to 205 mm SL (1.9 to 8.0 in.) with a mean length of 90.7 mm SL (3.6 in.).

a) Units 1&2 Abundance



b) Units 1&2 Biomass

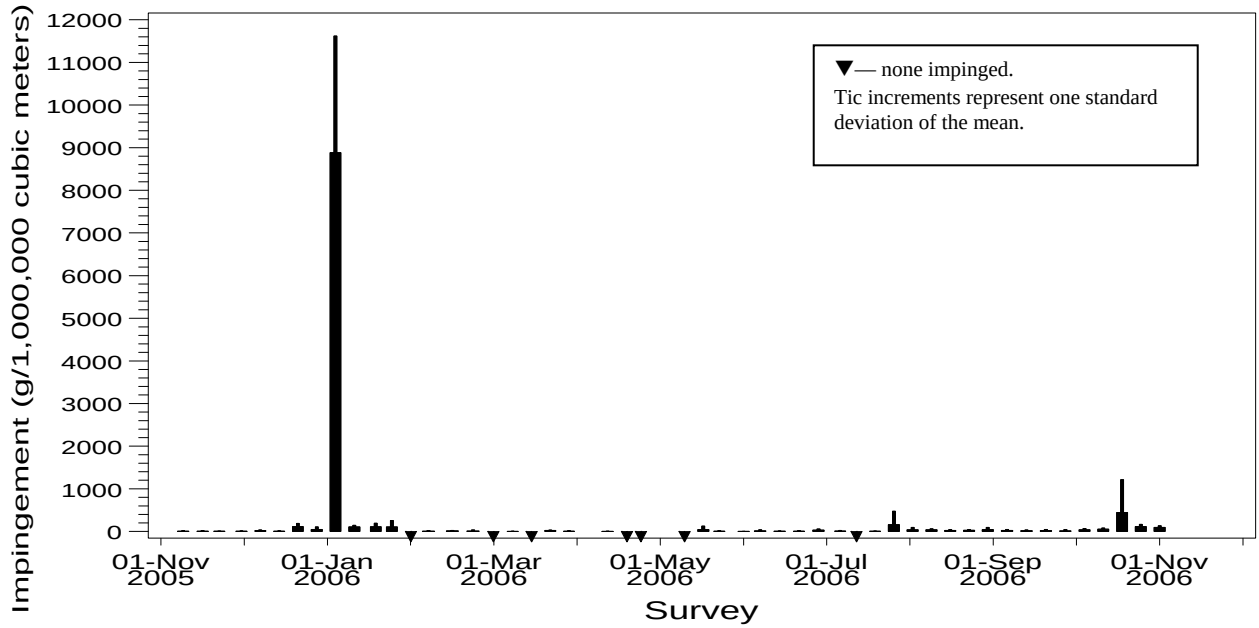
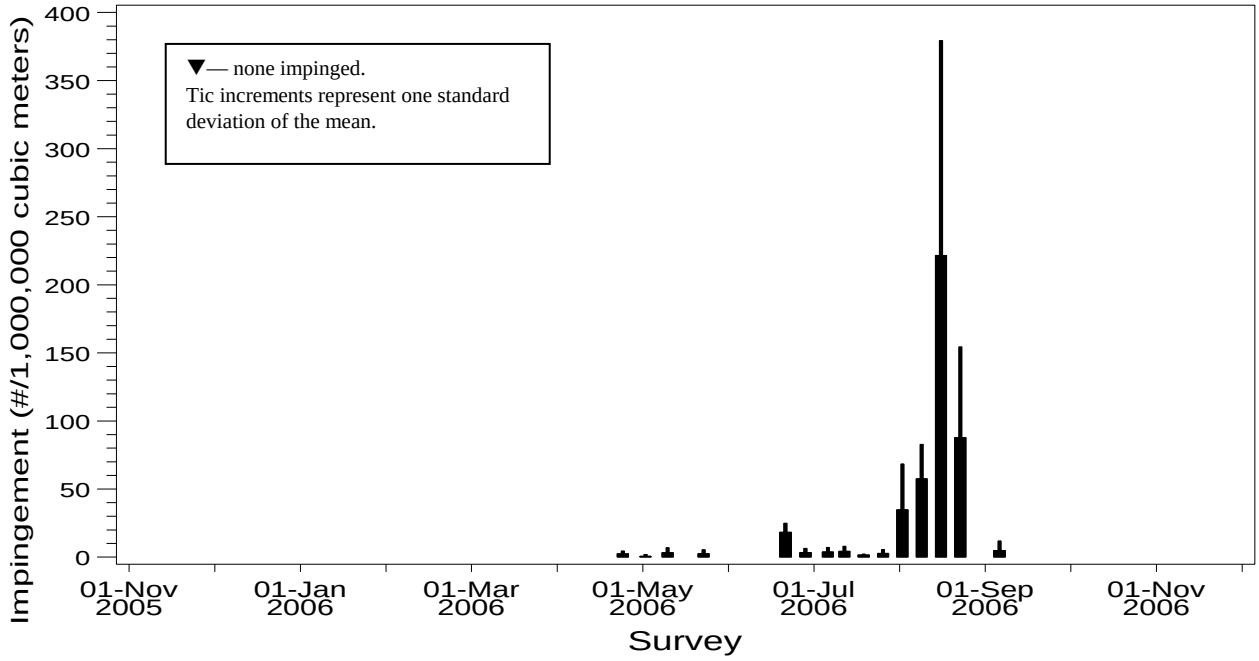


Figure 4-3. Estimated daily impingement of silversides based on the average impingement rate standardized by cooling water intake flow at MLPP Units 1&2 during the November 9, 2005–November 1, 2006 study.

a) Units 6&7 Abundance



b) Units 6&7 Biomass

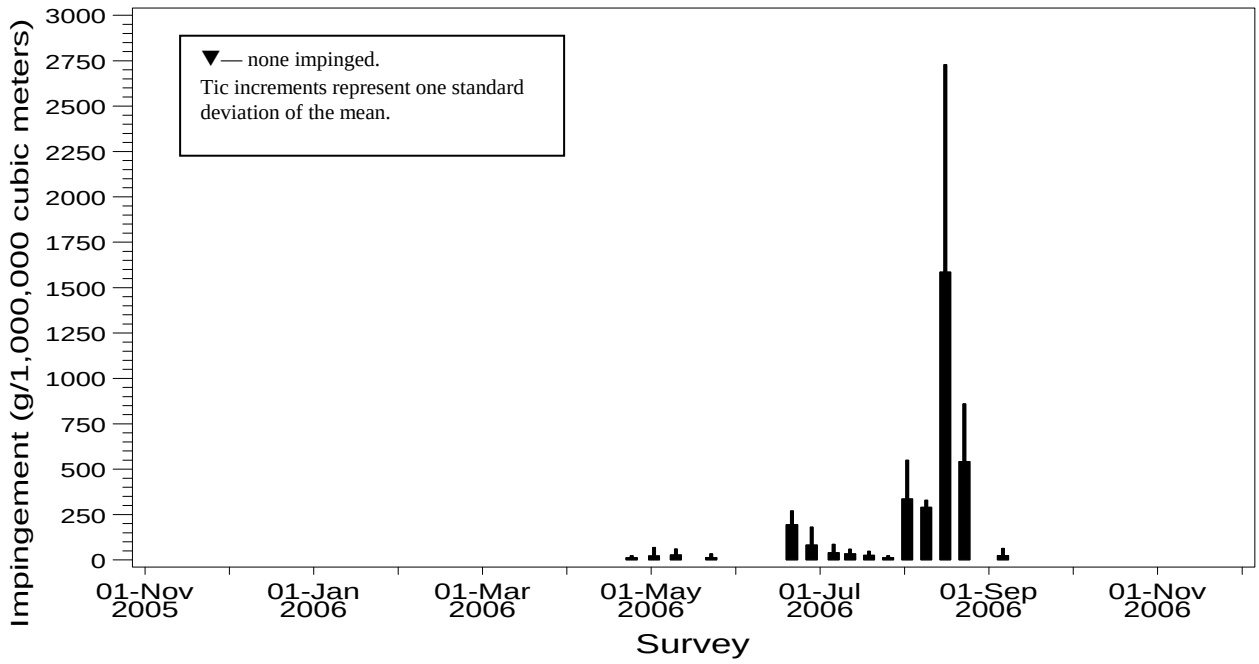
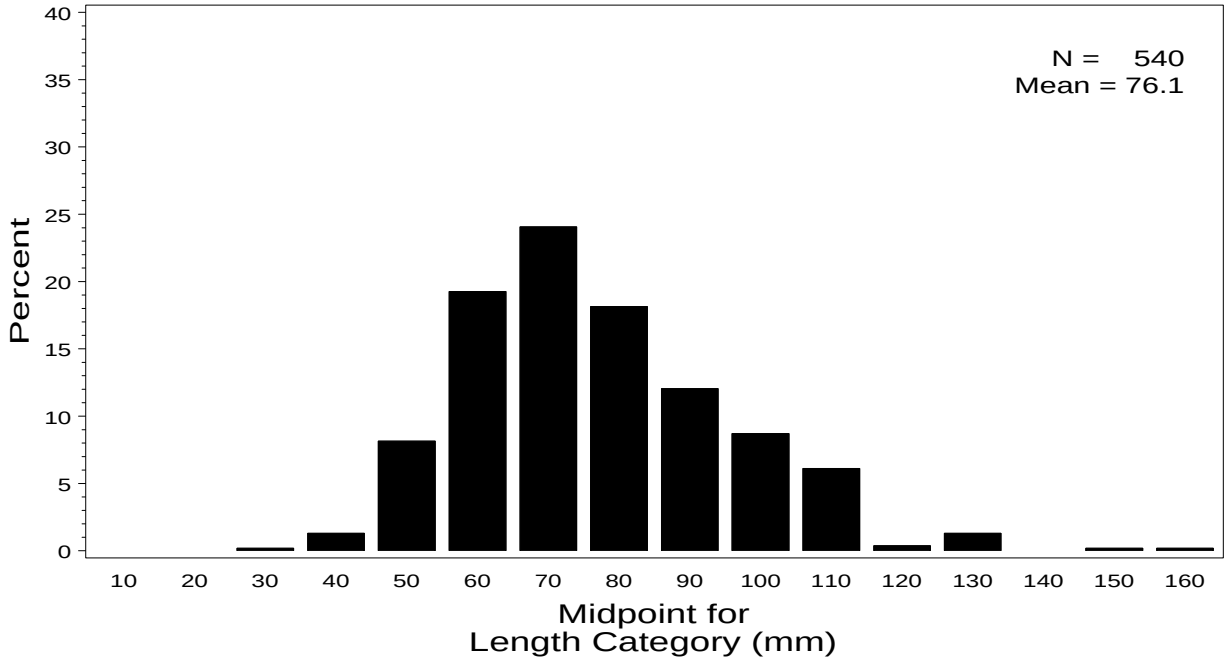


Figure 4-4. Estimated daily impingement of silversides based on the average impingement rate standardized by cooling water intake flow at MLPP Units 6&7 during the November 9, 2005–November 1, 2006 study.

a) Units 1&2



b) Units 6&7

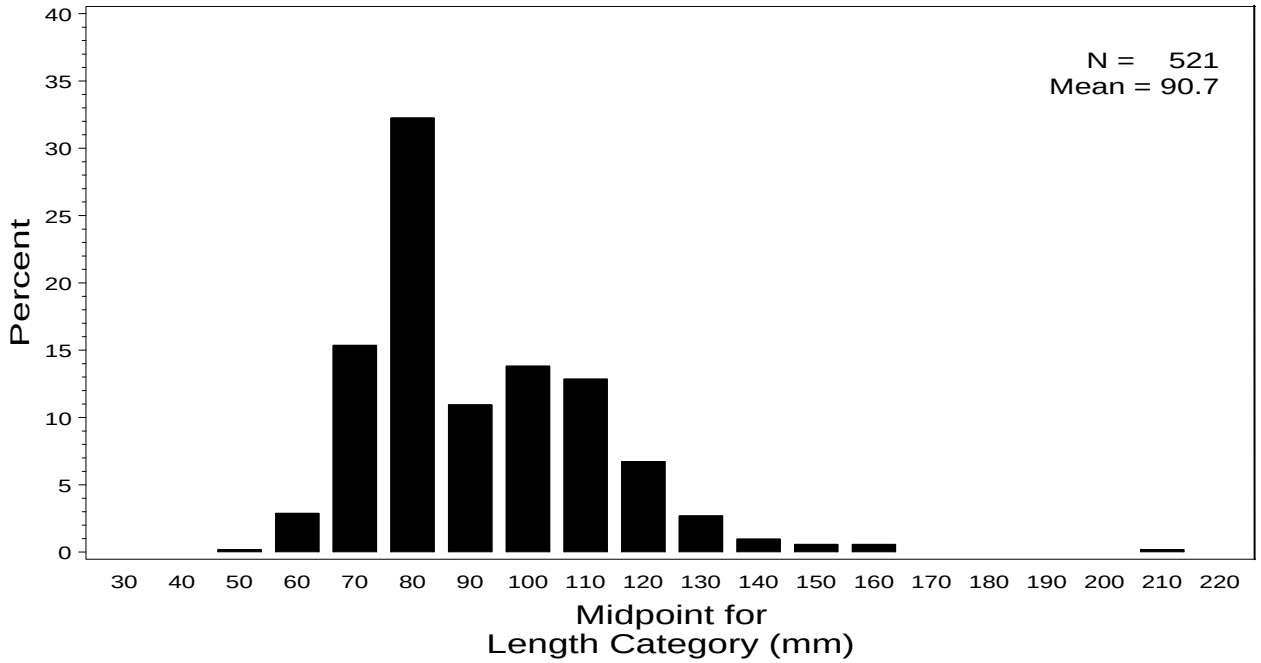


Figure 4-5. Length frequency distribution (mm SL) for topsmelt impinged at MLPP during the November 9, 2005–November 1, 2006 study.

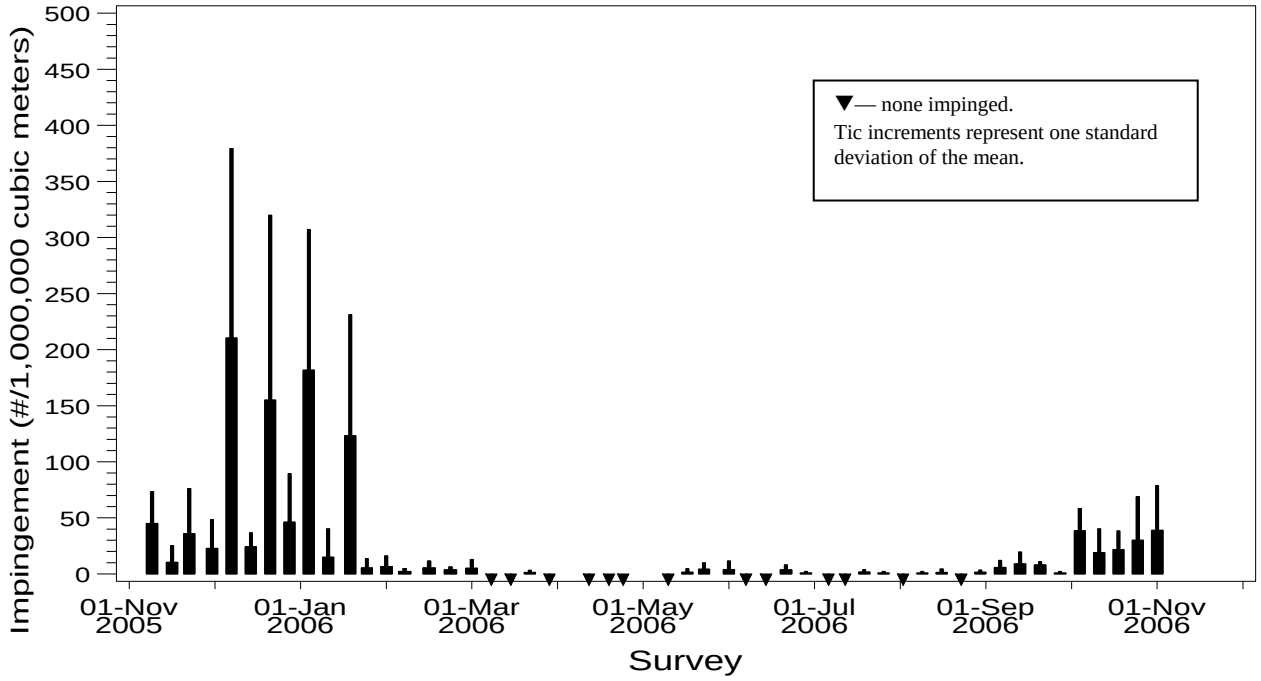
4.4.2 Plainfin midshipman Porichthys notatus

Plainfin midshipman comprised 15.9 percent of the total number of fishes impinged at the Units 1&2 traveling screens during the November 1, 2005–November 9, 2006 MLPP impingement study (Figure 4-1). A total of 1,358 plainfin midshipman weighing 2.6 kg (5.7 lb) were collected at Units 1&2 traveling screens (Table 4-1). Plainfin midshipman were collected in 37 of the 50 surveys conducted (Figure 4-6). A single plainfin midshipman was collected from the Units 1&2 bar racks (Table 4-1).

Plainfin midshipman comprised 1.3 percent of the total number of fishes impinged at the Units 6&7 traveling screens. A total of 276 plainfin midshipman weighing 3.6 kg (8.0 lb) were collected at Units 6&7 (Table 4-1). Plainfin midshipman were collected in 14 of the 15 surveys conducted (Figure 4-7).

A total of 909 plainfin midshipman were measured from impingement samples collected from the Units 1&2 traveling screens. They ranged in length from 28 to 174 mm SL (1.1 to 6.9 in.) with a mean of 51.8 mm SL (2.0 in.) (Figure 4-8a). Two hundred-fifty plainfin midshipman were measured from impingement samples collected from the Units 6&7 traveling screens. They ranged from 44 to 178 mm SL (1.7 to 7.0 in.) with mean length of 85.6 mm SL (3.4 in.) (Figure 4-8b).

a) Units 1&2 Abundance



b) Units 1&2 Biomass

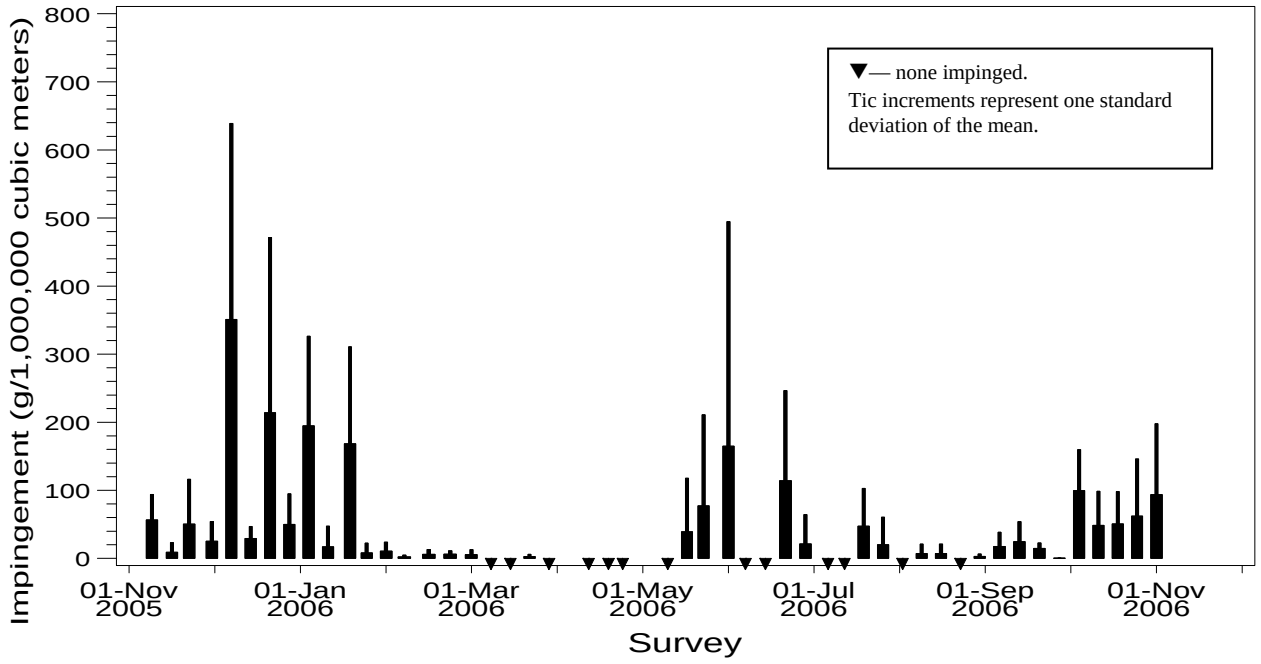
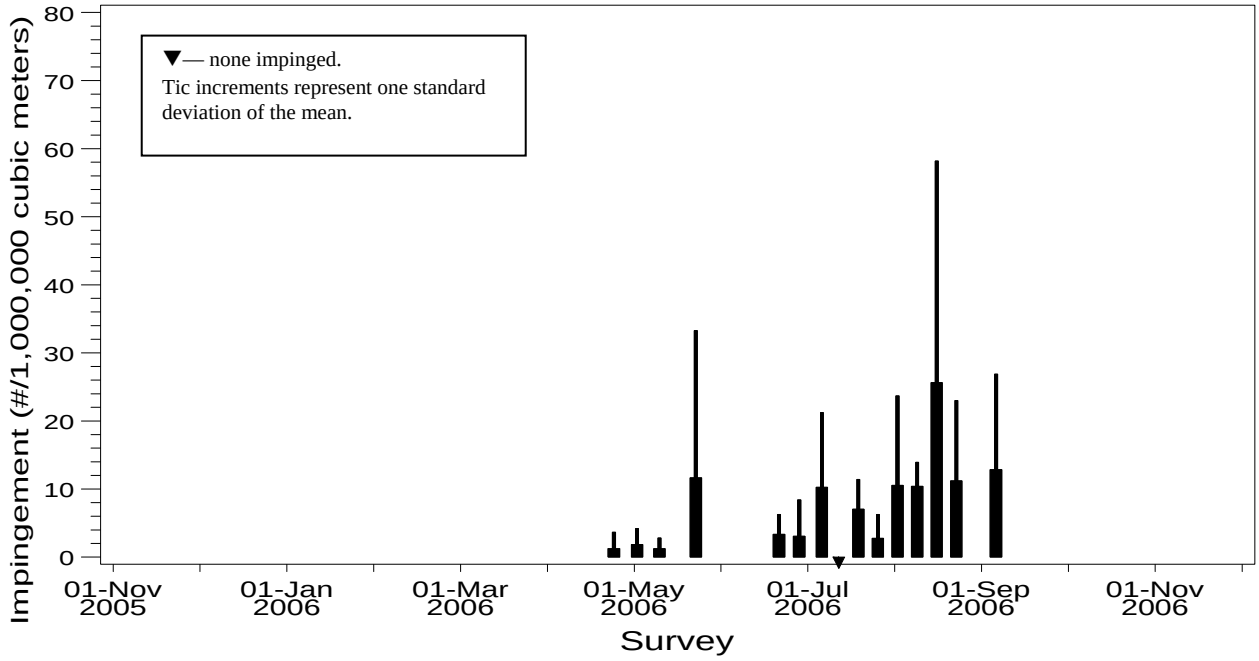


Figure 4-6. Estimated daily impingement of plainfin midshipman based on the average impingement rate standardized by cooling water intake flow at MLPP Units 1&2 during the November 9, 2005–November 1, 2006 study.

a) Units 6&7 Abundance



b) Units 6&7 Biomass

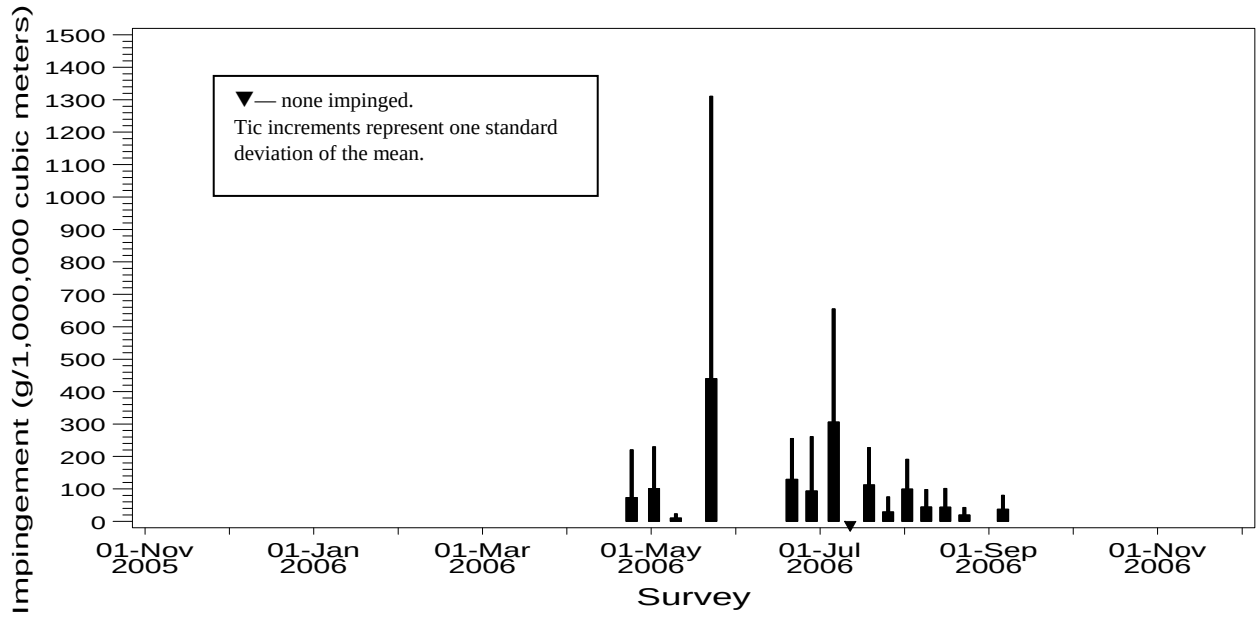
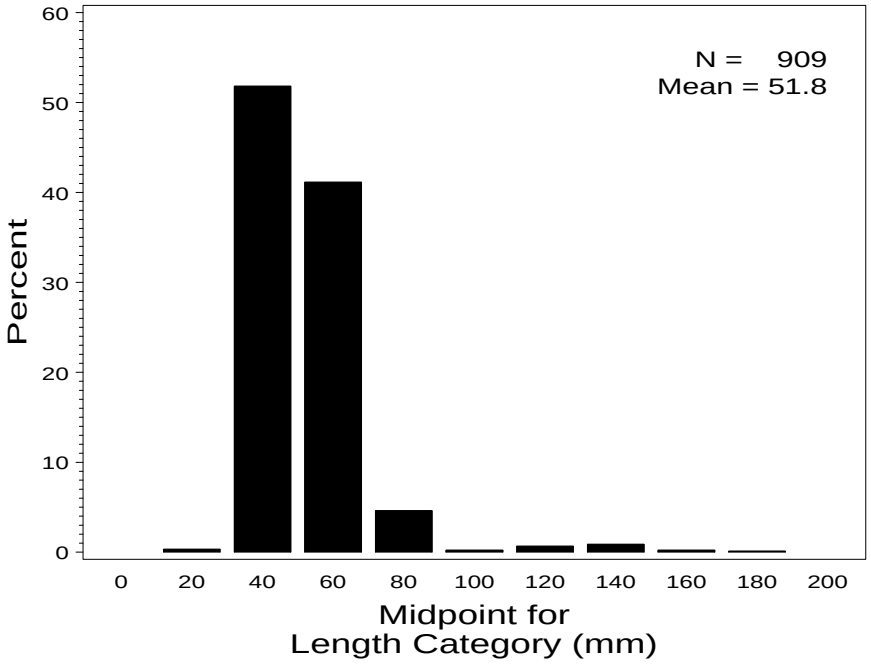


Figure 4.7. Estimated daily impingement of plainfin midshipman based on the average impingement rate standardized by cooling water intake flow at MLPP Units 6&7 during the November 9, 2005–November 1, 2006 study.

a) Units 1&2



b) Units 6&7

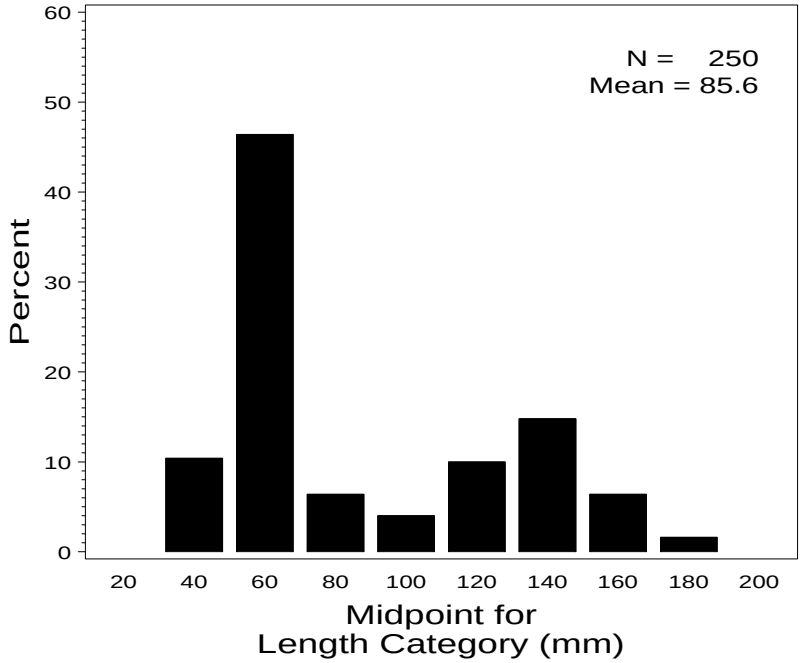


Figure 4-8. Length frequency distribution (mm SL) for plainfin midshipman impinged at the Moss Landing Power Plant during the November 9, 2005–November 1, 2006 study.

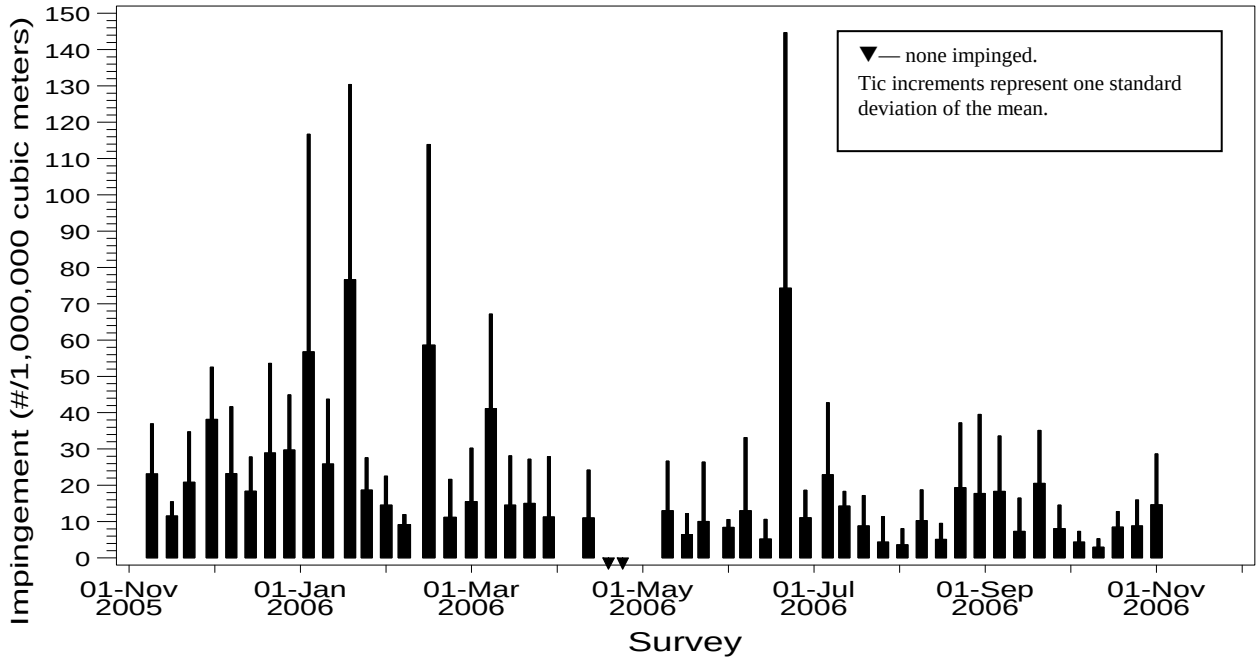
4.4.3 Pipefish Syngnathus spp.

Pipefish comprised 11.4 percent of the total number of fishes impinged at the Units 1&2 traveling screens during the November 1, 2005–November 9, 2006 MLPP impingement study (Figure 4-1). A total of 973 pipefish weighing 1.8 kg (3.9 lb) were collected at Units 1&2 traveling screens (Table 4-1). Pipefish were collected in 48 out of the 50 surveys (Figure 4-9), with most surveys yielding 5 to 50 pipefish. Four pipefish were collected from the Units 1&2 bar racks (Table 4-1).

Pipefish comprised less than 1 percent of the total number of fish impinged by individual count and biomass at the Units 6&7 intake. A total of 88 pipefish weighing 0.2 kg (0.4 lb) were collected at Units 6&7 (Table 4-1). Forty pipefish (approximately 45 percent of the total) were collected on a single survey on June 21, 2006. They were collected in 13 of the 15 surveys conducted at Units 6&7 (Figure 4-10).

A total of 933 pipefish were measured from impingement collections at the Units 1&2 traveling screens. They ranged in length from 37 mm to 355 mm SL (1.5 to 13.2 in.) and had a mean length of 174 mm SL (6.9 in.) (Figure 4-11a). A total of 86 pipefish were measured from impingement collections at the Units 6&7 traveling screens. They ranged in length from 66 mm to 298 mm SL (2.6 to 11.7 in.) and had a mean length of 183 mm SL (7.2 in.) (Figure 4-11b).

a) Units 1&2 Abundance



b) Units 1&2 Biomass

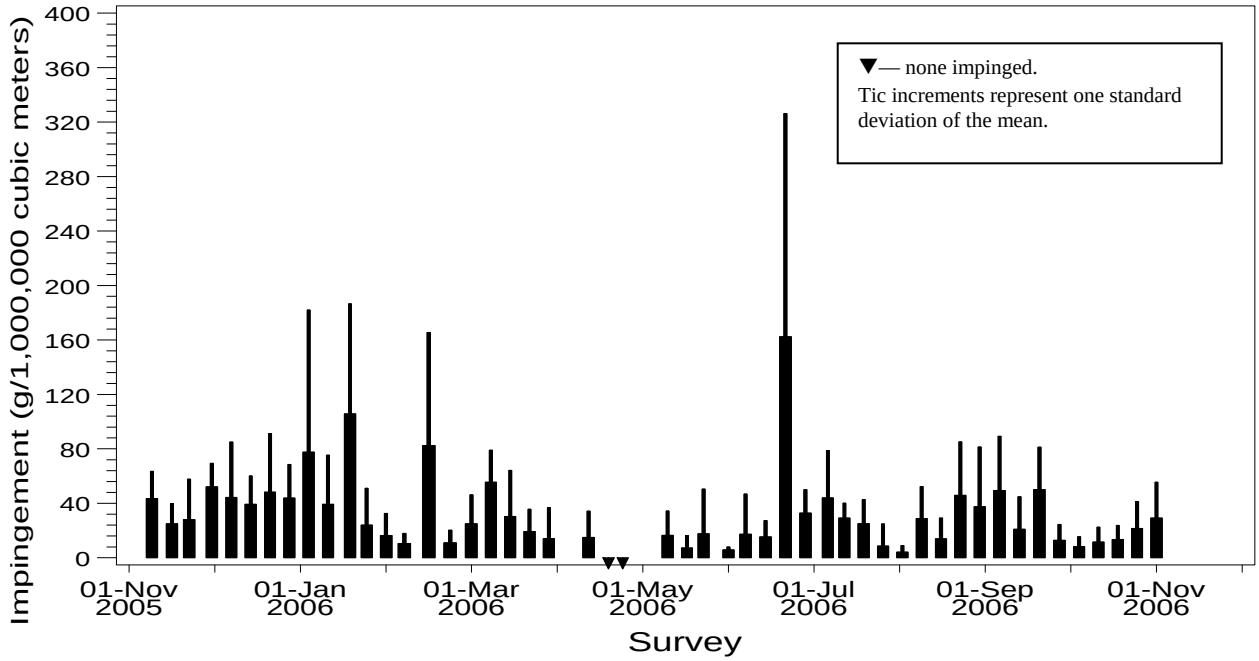
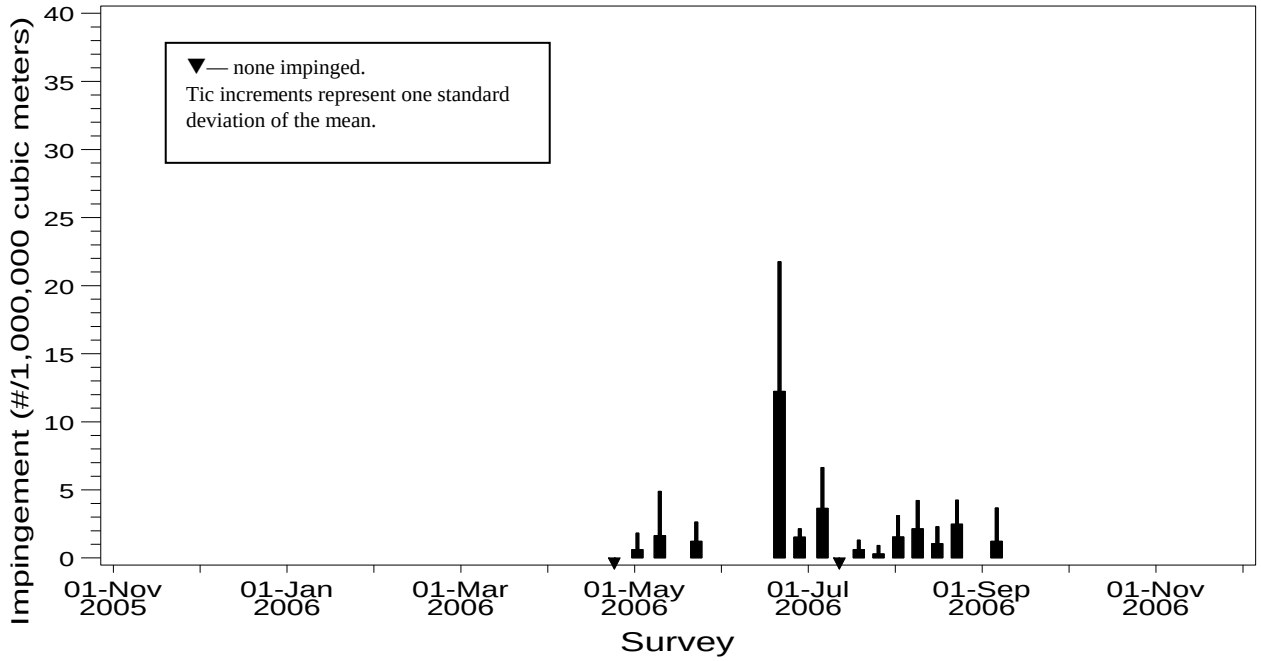


Figure 4-9. Estimated daily impingement of pipefish based on the average impingement rate standardized by cooling water intake flow at MLPP Units 1&2 during the November 9, 2005–November 1, 2006 study.

a) Units 6&7 Abundance



b) Units 6&7 Biomass

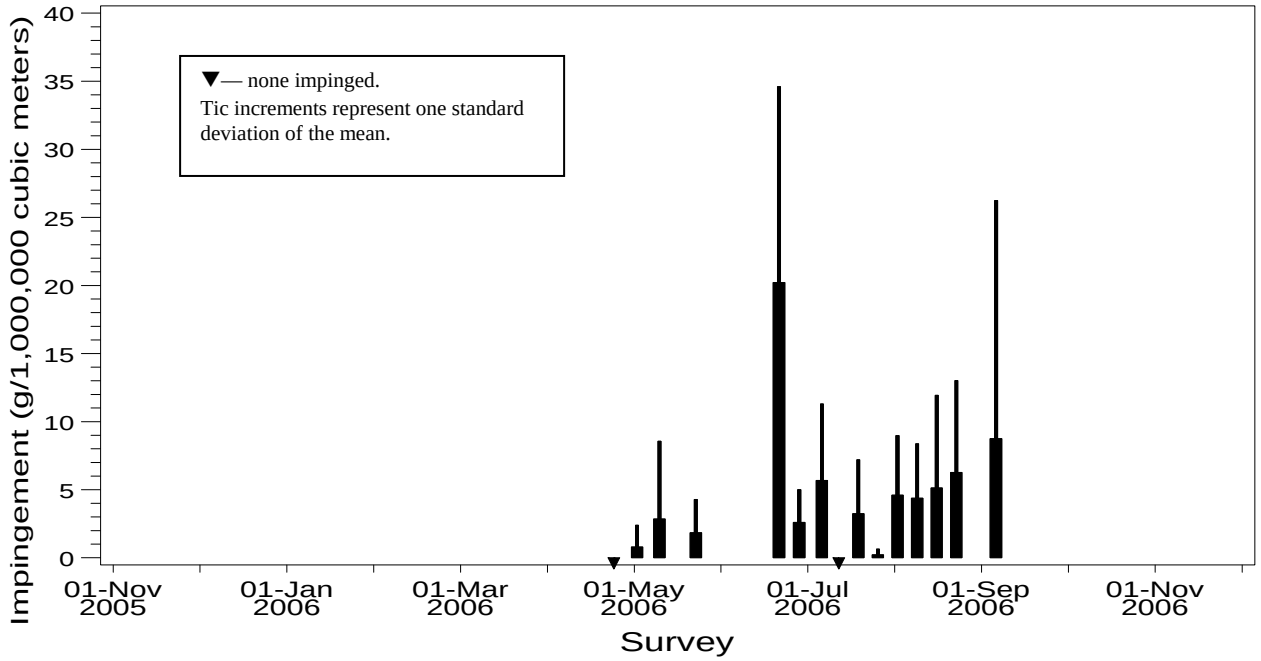
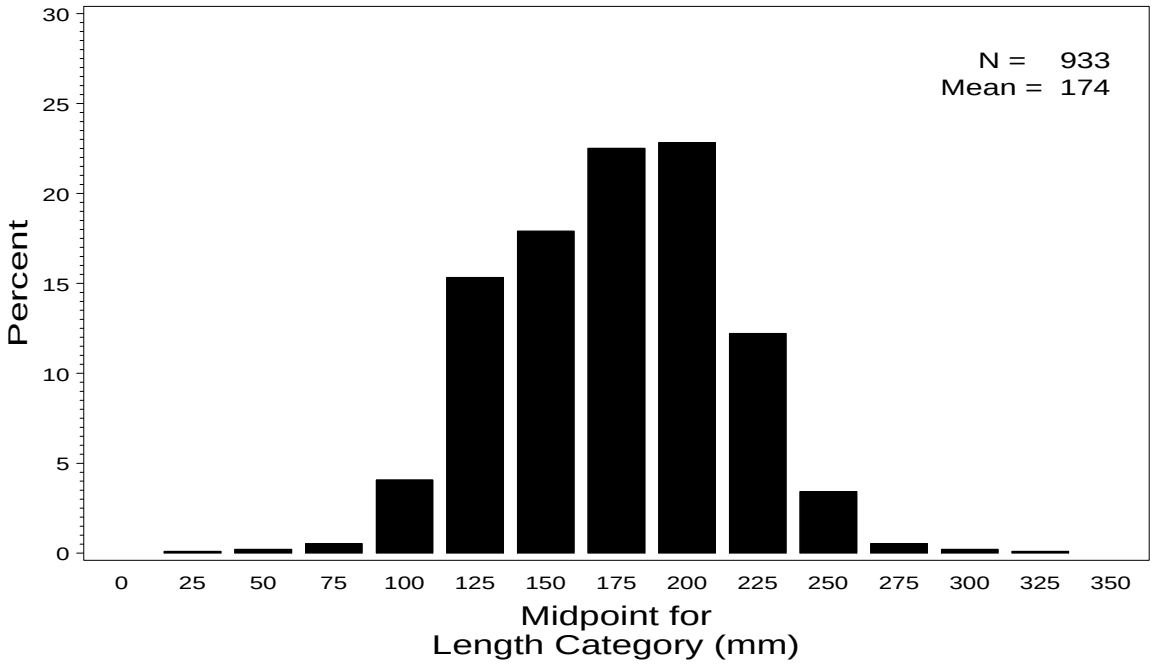


Figure 4-10. Estimated daily impingement of pipefish based on the average impingement rate standardized by cooling water intake flow at MLPP Units 6&7 during the November 9, 2005–November 1, 2006 study.

a) Units 1&2



b) Units 6&7

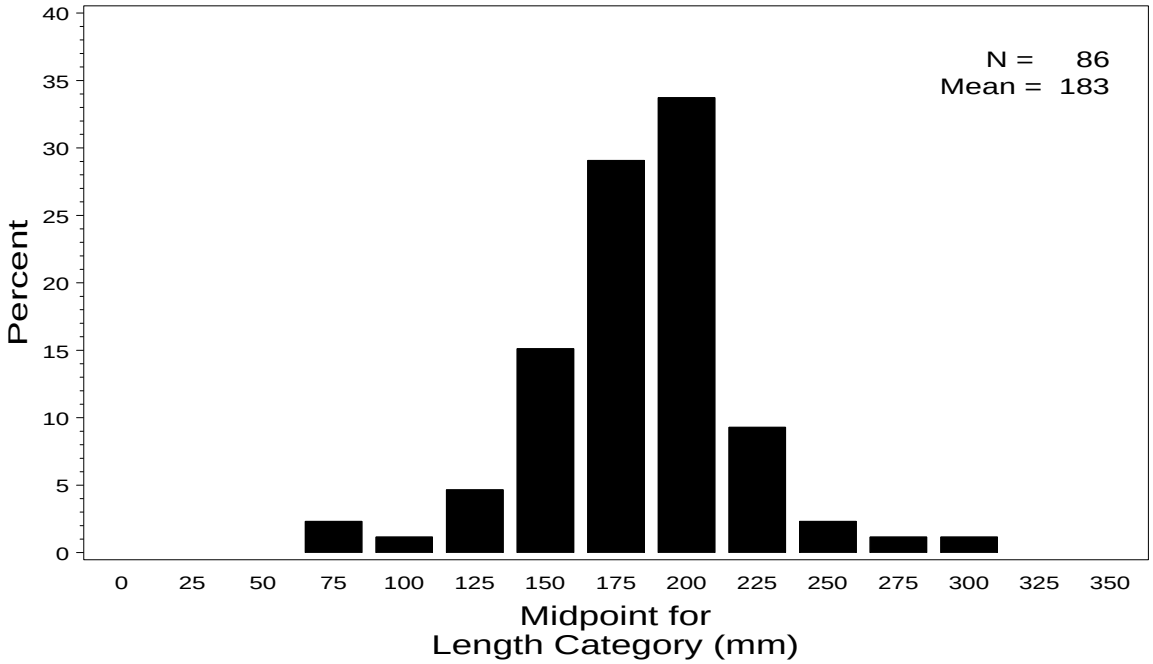


Figure 4-11. Length frequency distribution (mm SL) for pipefish impinged at the Moss Landing Power Plant during the November 9, 2005–November 1, 2006 study.

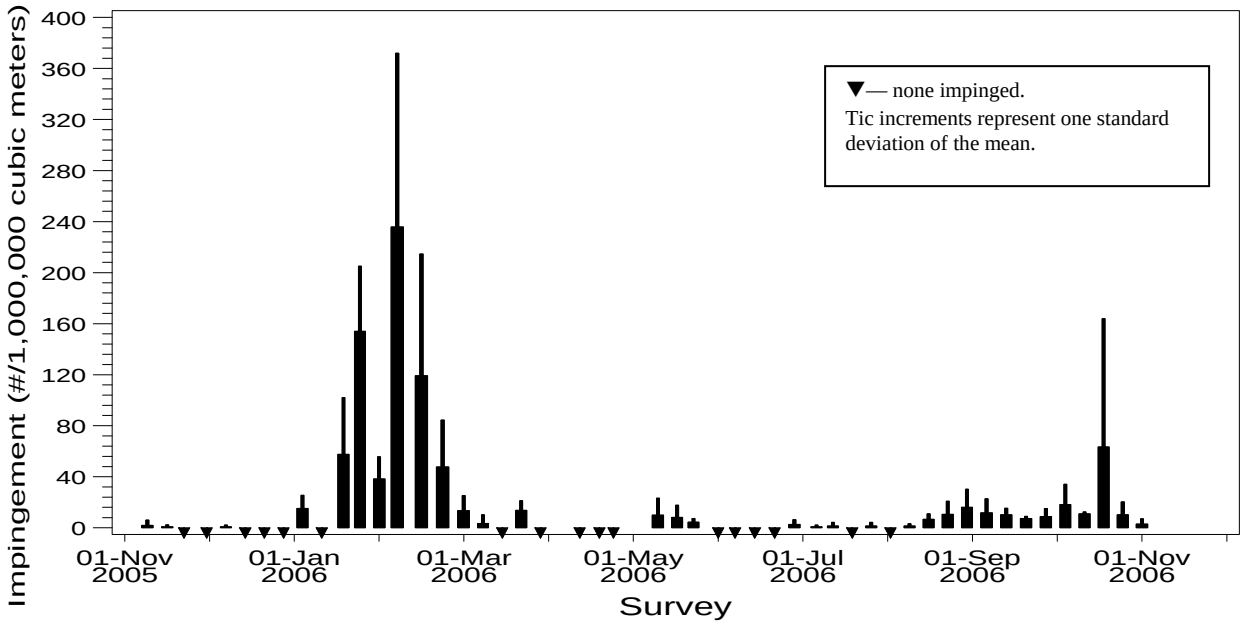
4.4.4 Northern anchovy Engraulis mordax

Northern anchovy comprised 9.6 percent of the total number of fishes impinged at the Units 1&2 traveling screens during the November 1, 2005–November 9, 2006 MLPP impingement study (Figure 4-1). A total of 818 northern anchovy weighing 3.9 kg (8.8 lb) were collected at the Units 1&2 traveling screens (Table 4-1). Northern anchovy were collected in 33 of the 50 surveys (Figure 4-12). Most occurrences of northern anchovy in the collections were small and ranged from 1 to 25 individuals, but occasionally large numbers (140 to 175 individuals) of northern anchovy were collected (Appendix B). No northern anchovy were collected from the Units 1&2 bar racks.

Northern anchovy comprised 79.4 percent of the total number of fishes impinged at the Units 6&7 traveling screens (Figure 4-2). A total of 16,462 northern anchovy weighing 77.8 kg (172 lb) were collected at Units 6&7 during the impingement study at MLPP (Table 4-1). Northern anchovy were the most common fish collected at Units 6&7 both by number of individuals and biomass. Northern anchovy were collected during all surveys (Figure 4-13). Approximately 89 percent (14,619 individuals) of the total number of northern anchovy impinged were collected during a single survey on August 23, 2006 (Appendix B).

A total of 634 northern anchovy were measured from impingement collections at the Units 1&2 traveling screens. They ranged in length from 54 to 143 mm SL (2.1 to 5.6 in.) with a mean length of 87.3 mm SL (3.4 in.) (Figure 4-14a). A total of 801 northern anchovy were measured from impingement samples and ranged in length from 36 to 147 mm SL (1.4 to 5.8 in.) with a mean of 112 mm SL (4.4 in.) (Figure 4-14b).

a) Units 1&2 Abundance



b) Units 1&2 Biomass

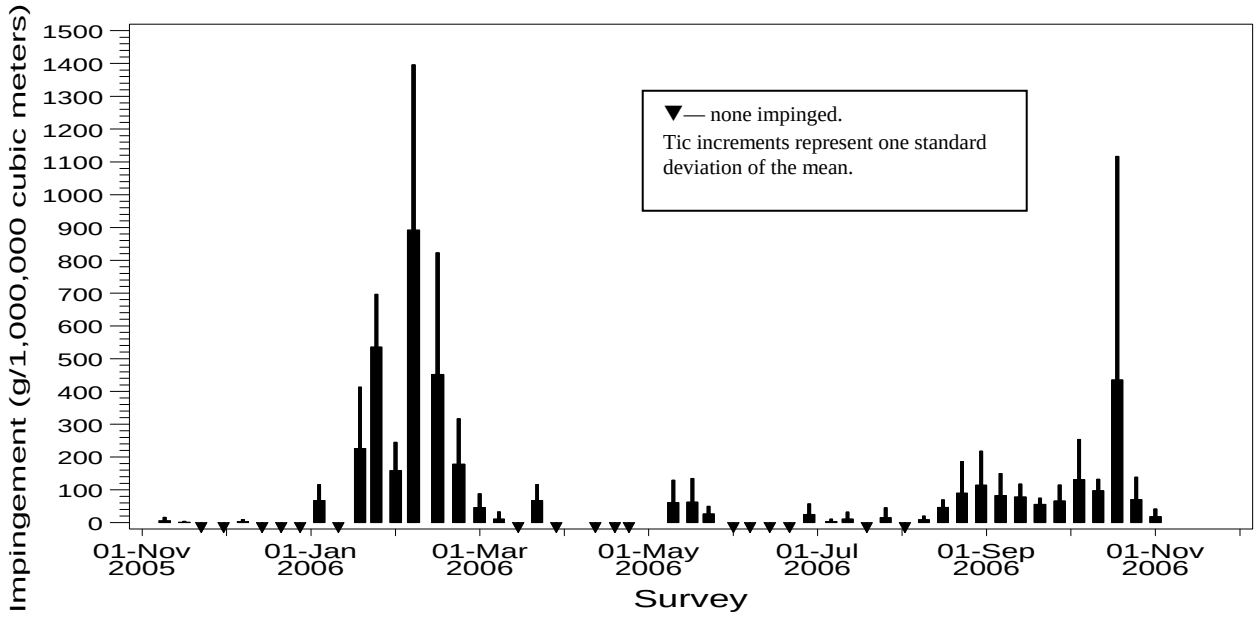
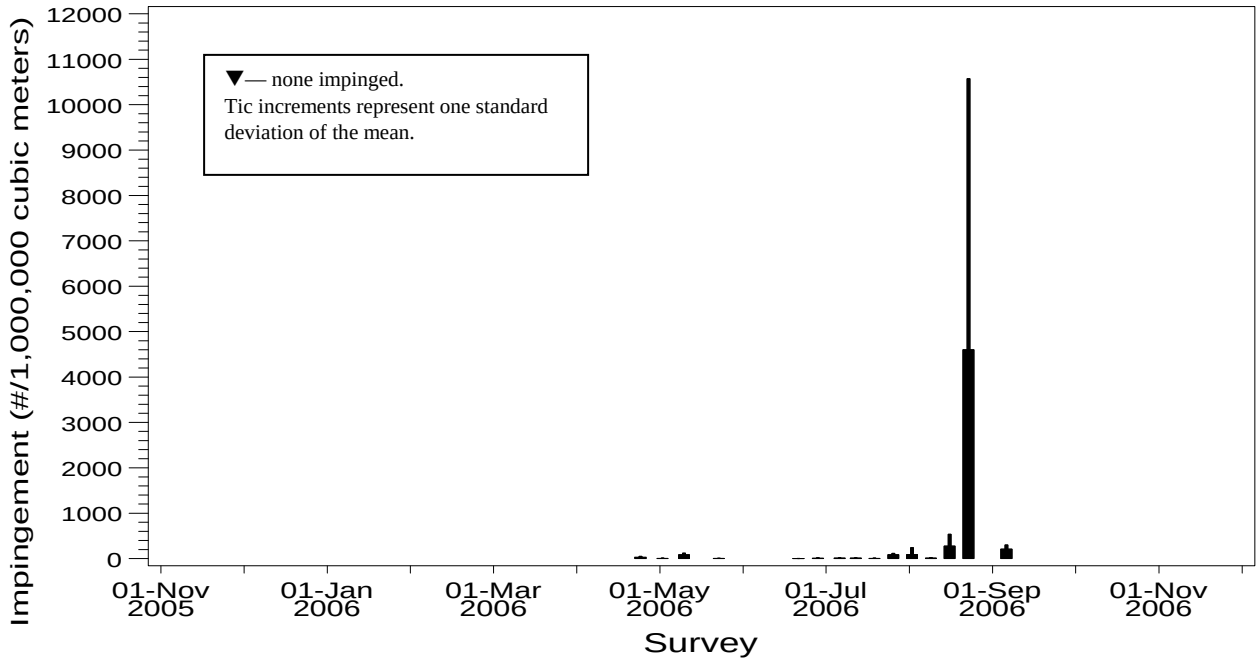


Figure 4-12. Estimated daily impingement of northern anchovy based on the average impingement rate standardized by cooling water intake flow at MLPP Units 1&2 during the November 9, 2005–November 1, 2006 study.

a) Units 6&7 Abundance



b) Units 6&7 Biomass

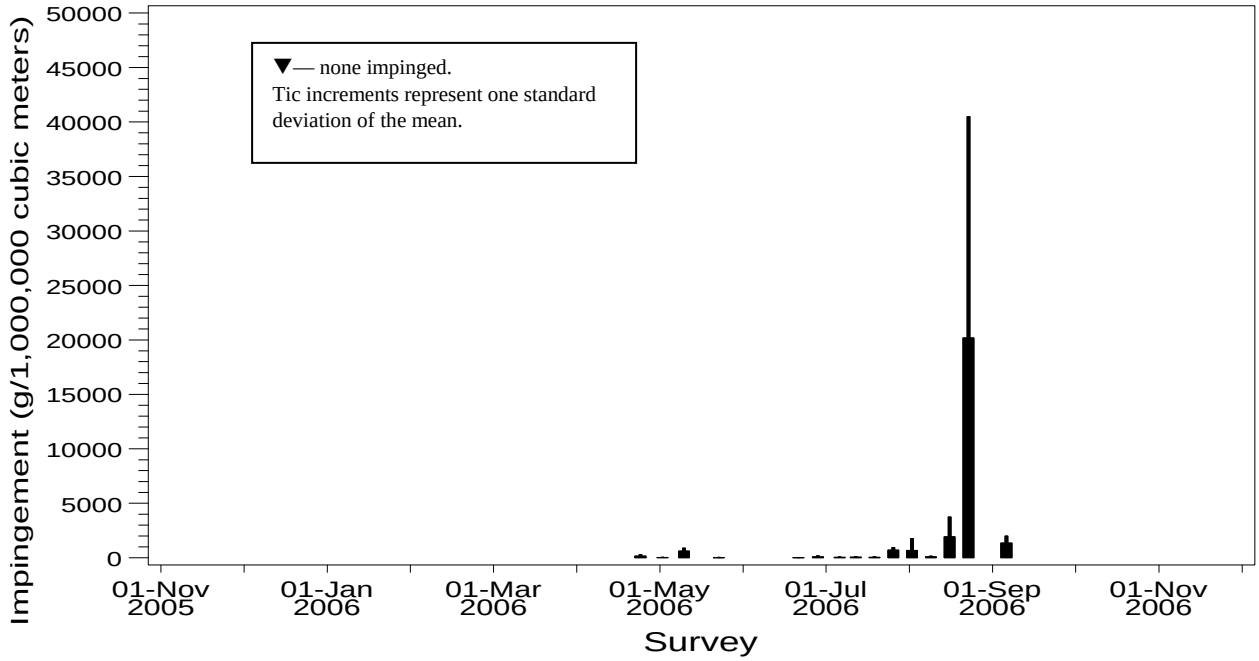
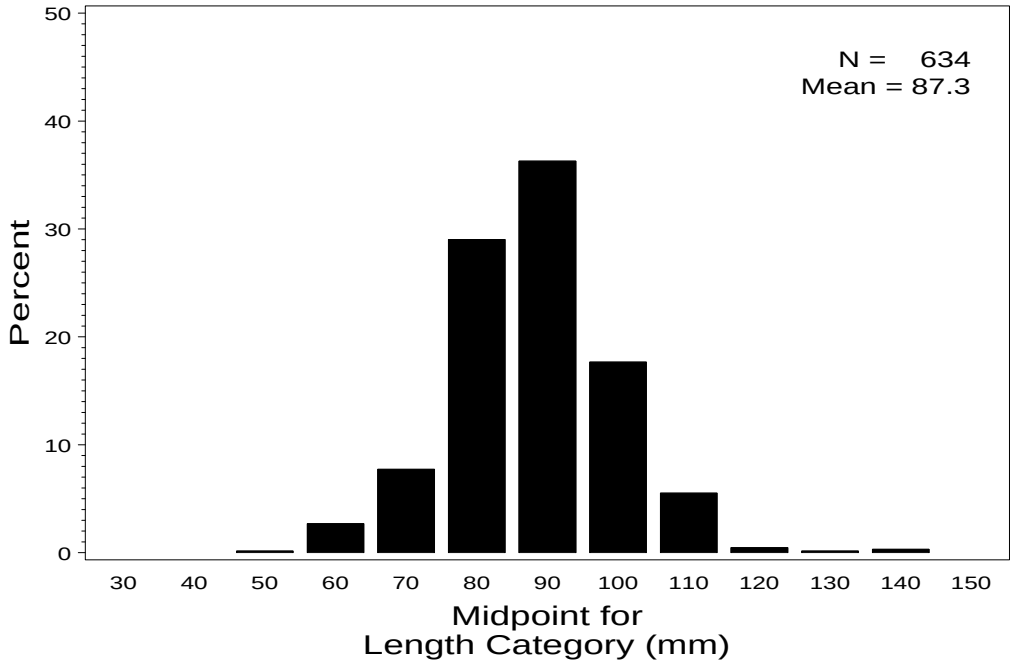


Figure 4-13. Estimated daily impingement of northern anchovy based on the average impingement rate standardized by cooling water intake flow at MLPP Units 6&7 during the November 9, 2005–November 1, 2006 study.

a) Units 1&2



b) Units 6&7

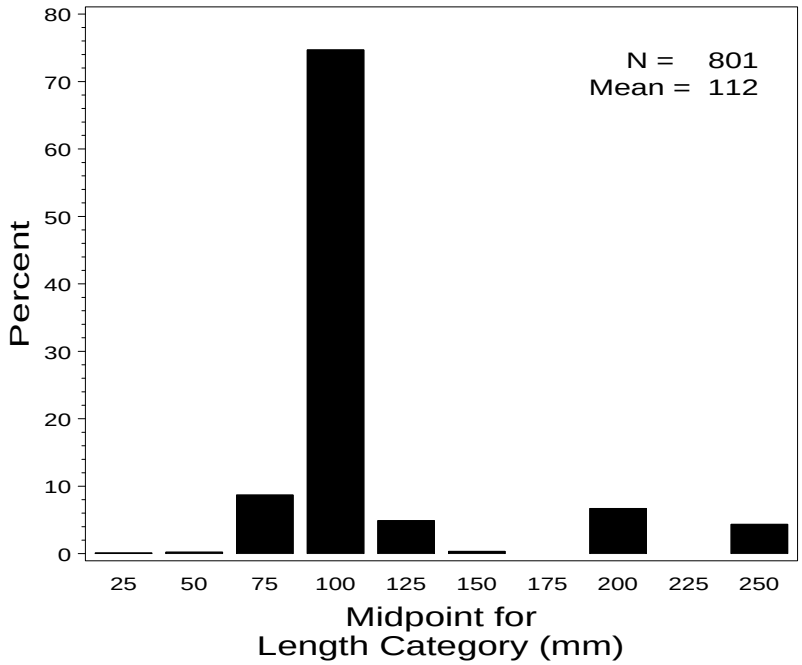


Figure 4-14. Length frequency distribution (mm SL) for northern anchovy impinged at the Moss Landing Power Plant during the November 9, 2005–November 1, 2006 study.

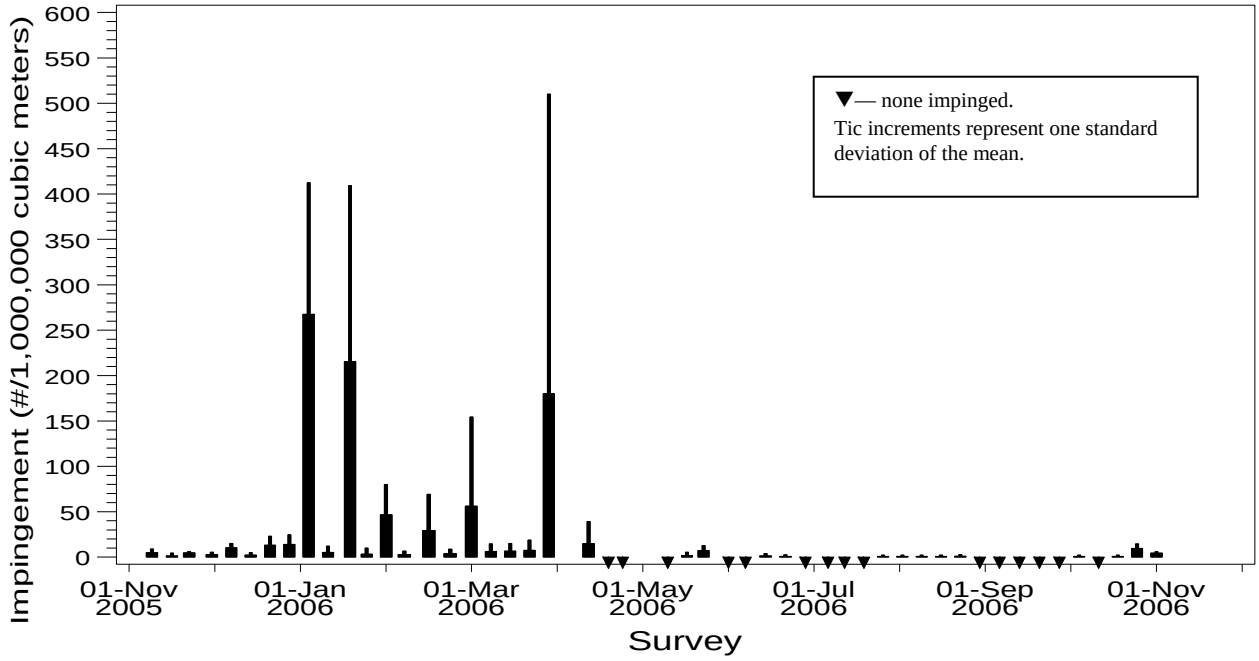
4.4.5 Sanddabs Citharichthys spp.

Sanddabs (speckled sanddab and a group of sanddabs that could not be identified to species) comprised 9.3 percent of the total number of fishes impinged at the Units 1&2 traveling screens during the November 1, 2005–November 9, 2006 MLPP impingement study (Figure 4-1). A total of 792 sanddabs weighing 0.9 kg (1.9 lb) were collected at the Units 1&2 traveling screens (Table 4-1). Sanddabs were collected in 35 of the 50 surveys (Figure 4-15) with the majority of the sanddabs (86 percent) collected from January through March 2006 (Appendix B). No sanddabs were collected from the Units 1&2 bar racks (Table 4-1).

Sanddabs comprised 2.4 percent of the total number of fishes impinged at the Units 6&7 traveling screens (Figure 4-2). A total of 487 sanddabs weighing 3.3 kg (7.4 lb) were collected at Units 6&7 (Table 4-1). Sanddabs were collected during all 15 surveys (Figure 4-16).

A total of 510 sanddabs were measured from impingement collections at the Units 1&2 traveling screens. Sanddabs ranged from 16 to 172 mm SL (0.6 to 6.8 in.) with a mean of 40.5 mm SL (1.6 in.) (Figure 4-17a). A total of 441 sanddabs were measured from impingement collections at the Units 6&7 traveling screens. Sanddabs ranged from 38 to 175 mm SL (1.5 to 6.9 in.) with a mean of 72.0 mm SL (2.8 in.) (Figure 4-17b).

a) Units 1&2 Abundance



b) Units 1&2 Biomass

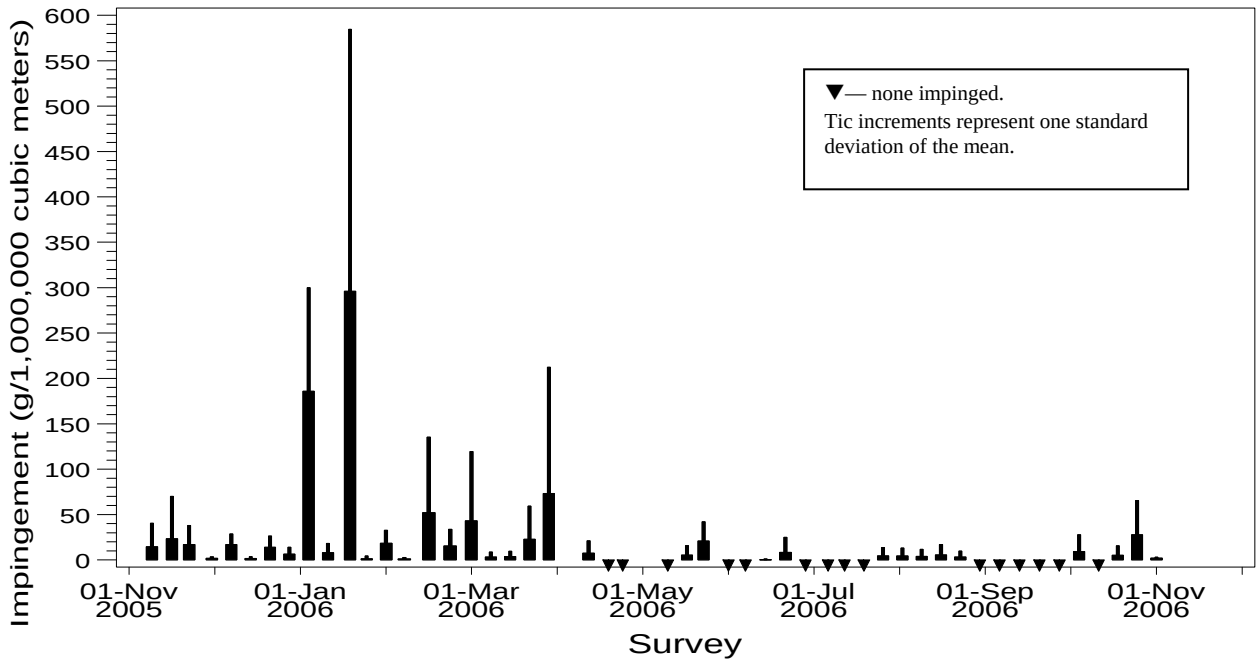
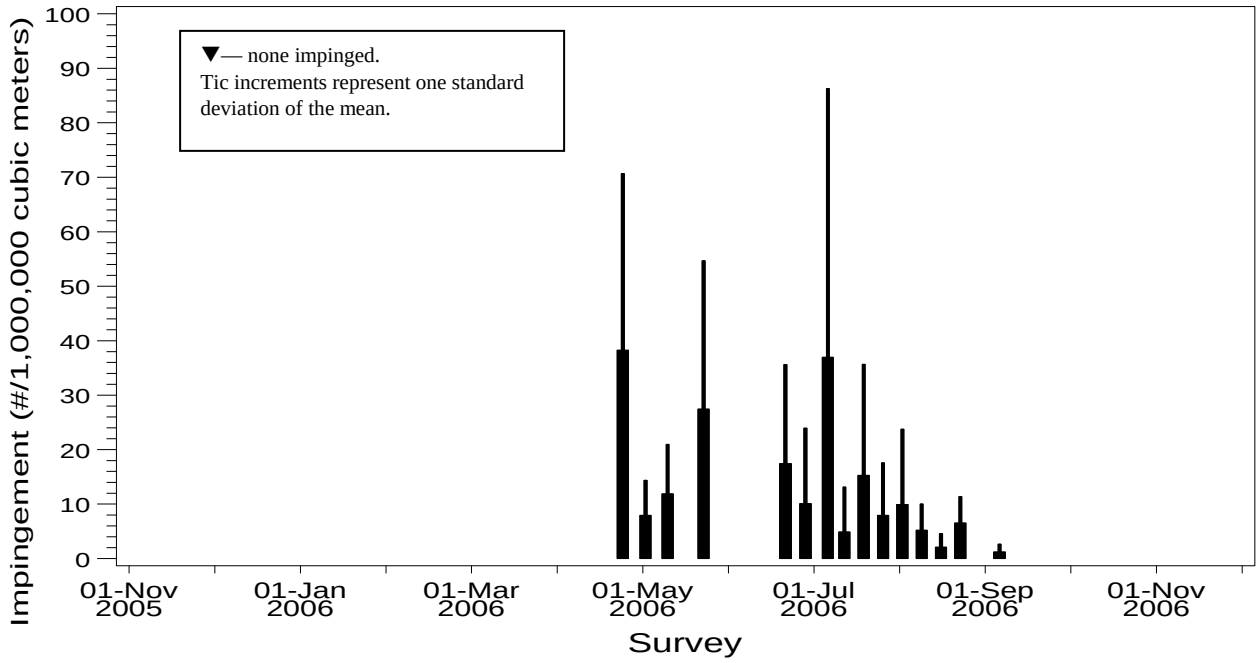


Figure 4-15. Estimated daily impingement of sanddabs based on the average impingement rate standardized by cooling water intake flow at MLPP Units 1&2 during the November 9, 2005–November 1, 2006 study.

a) Units 6&7 Abundance



b) Units 6&7 Biomass

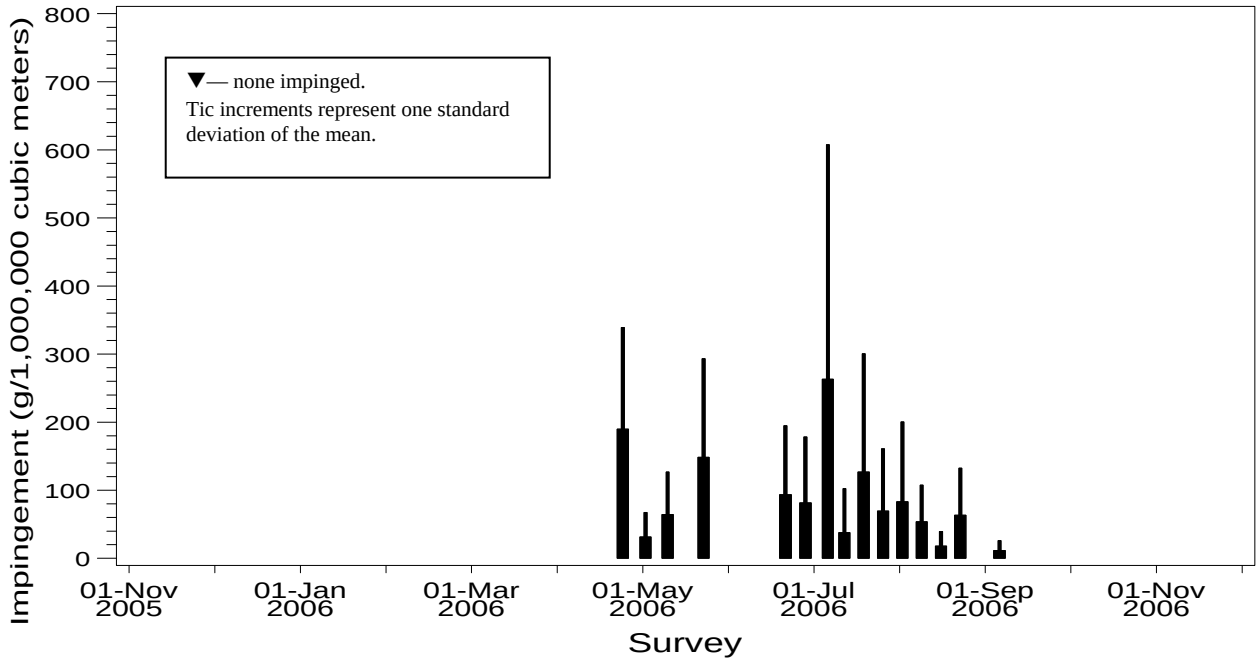
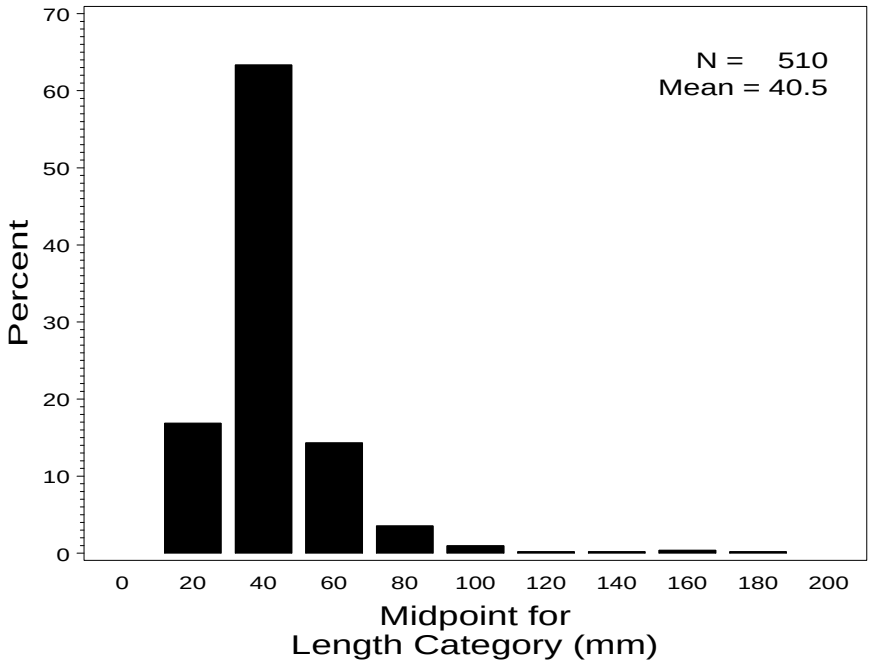


Figure 4-16. Estimated daily impingement of sanddabs based on the average impingement rate standardized by cooling water intake flow at MLPP Units 6&7 during the November 9, 2005–November 1, 2006 study.

a) Units 1&2



b) Units 6&7

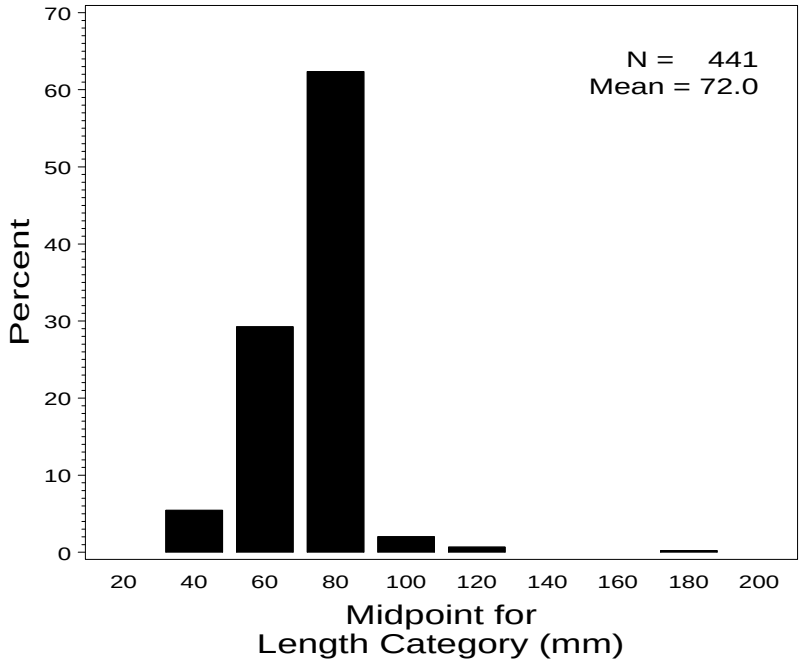


Figure 4-17. Length frequency distribution (mm SL) for sanddabs impinged at the Moss Landing Power Plant during the November 1, 2005–November 9, 2006 study.

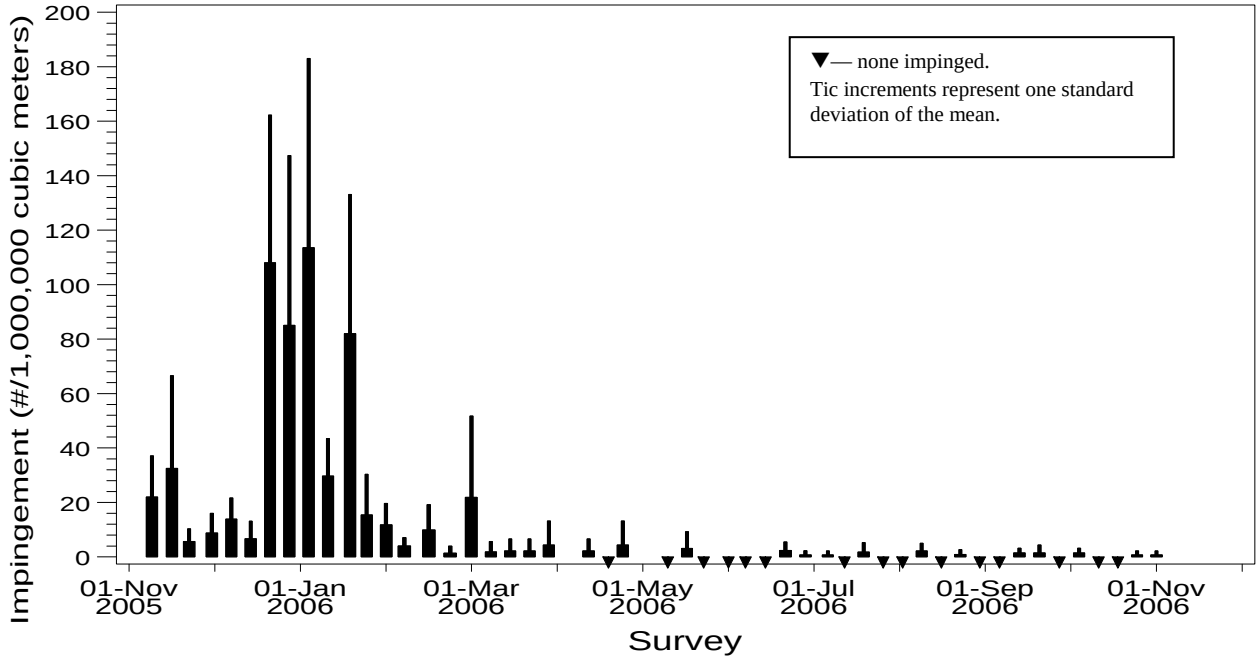
4.4.6 Arrow Goby Clevelandia ios

Arrow goby comprised 8.1 percent of the total number of fishes impinged at the Units 1&2 traveling screens during the November 1, 2005–November 9, 2006 MLPP impingement study (Figure 4-1). A total of 693 arrow goby weighing 0.8 kg (1.7 lb) were collected at the Units 1&2 traveling screens (Table 4-1). Arrow goby were collected in 35 of the 50 surveys (Figure 4-18). Three arrow goby were collected from the Units 1&2 bar racks (Table 4-1).

Arrow goby comprised less than 0.1 percent of the total number of fishes impinged at the Units 6&7 traveling screens. A total of five arrow goby weighing 16.4 g (0.04 lb) were collected at Units 6&7 (Table 4-1). Arrow goby were collected in 3 of the 15 surveys (Figure 4-19).

A total of 592 arrow goby was measured from impingement samples collected at the Units 1&2 traveling screens. They ranged 29 to 88 mm SL (1.1 to 3.5 in.) with a mean of 48.9 mm SL (1.9 in.) (Figure 4-20a). All arrow goby (n=5) were measured from impingement collections at the Units 6&7 intake. They ranged from 42 to 83 mm SL (1.7 to 3.3 in.) with a mean of 62.2 mm SL (2.5 in.) (Figure 4-20b).

a) Units 1&2 Abundance



b) Units 1&2 Biomass

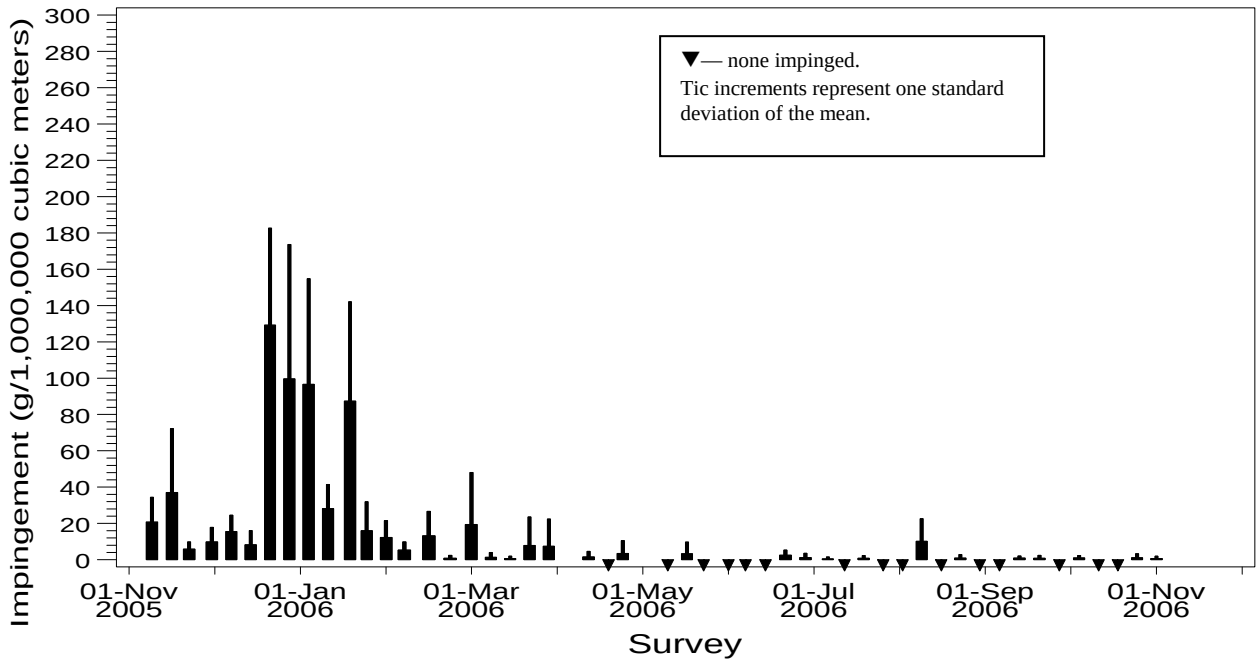
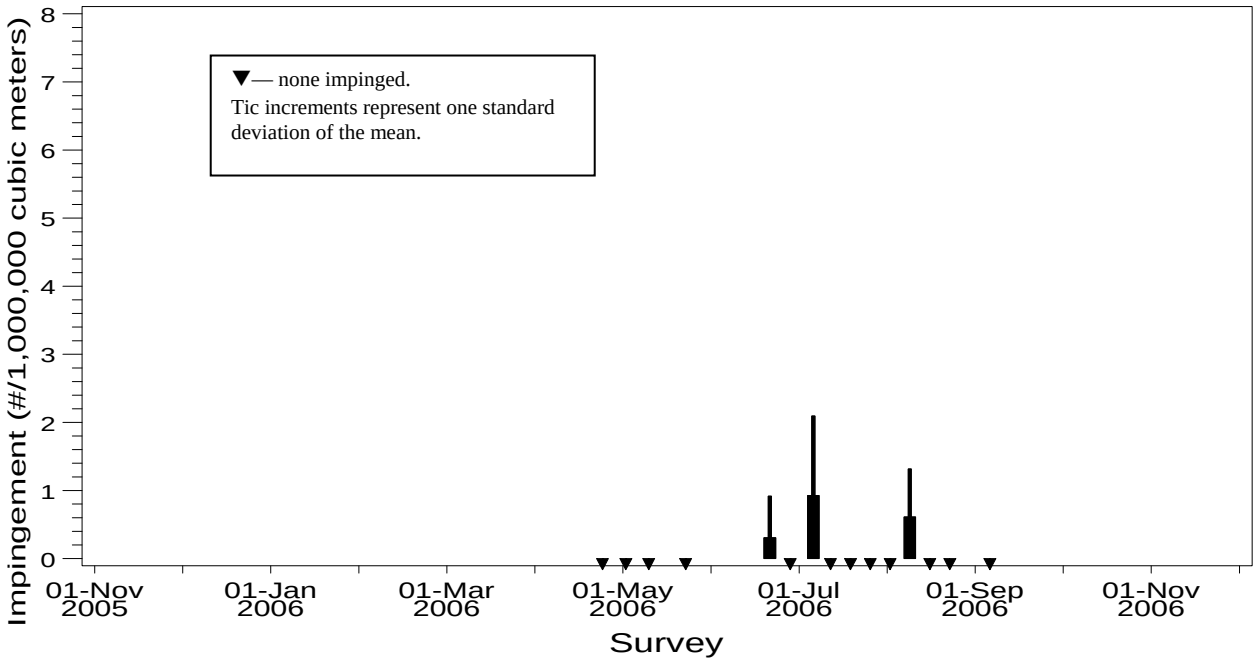


Figure 4-18. Estimated daily impingement of arrow goby based on the average impingement rate standardized by cooling water intake flow at MLPP Units 1&2 during the November 9, 2005–November 1, 2006 study.

a) Units 6&7 Abundance



b) Units 6&7 Biomass

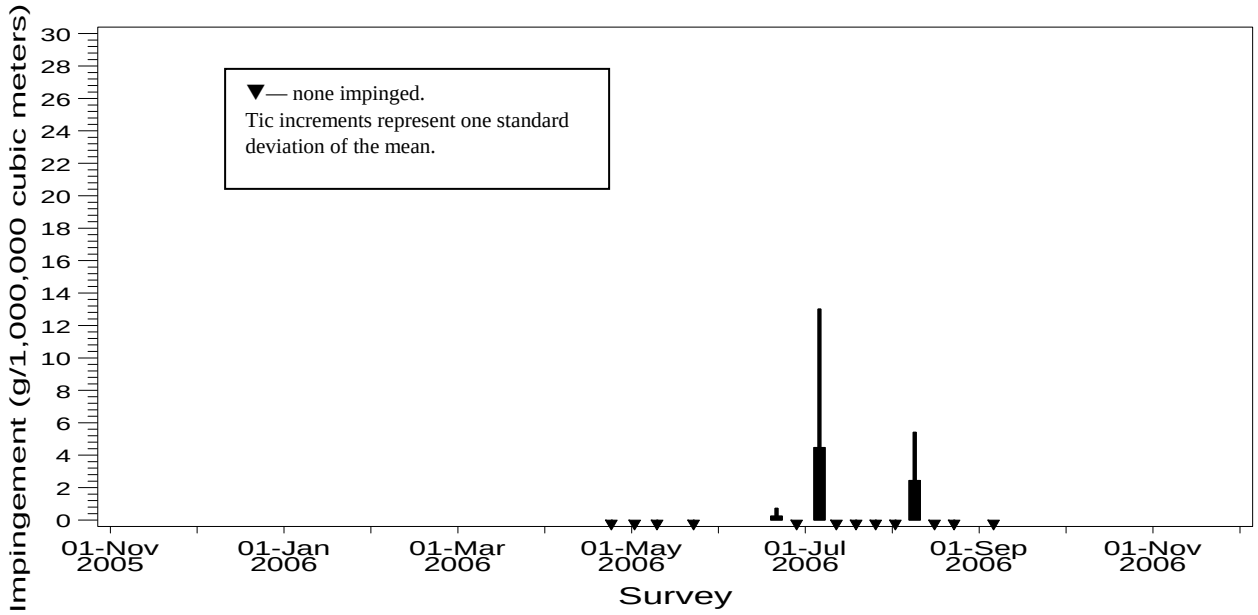
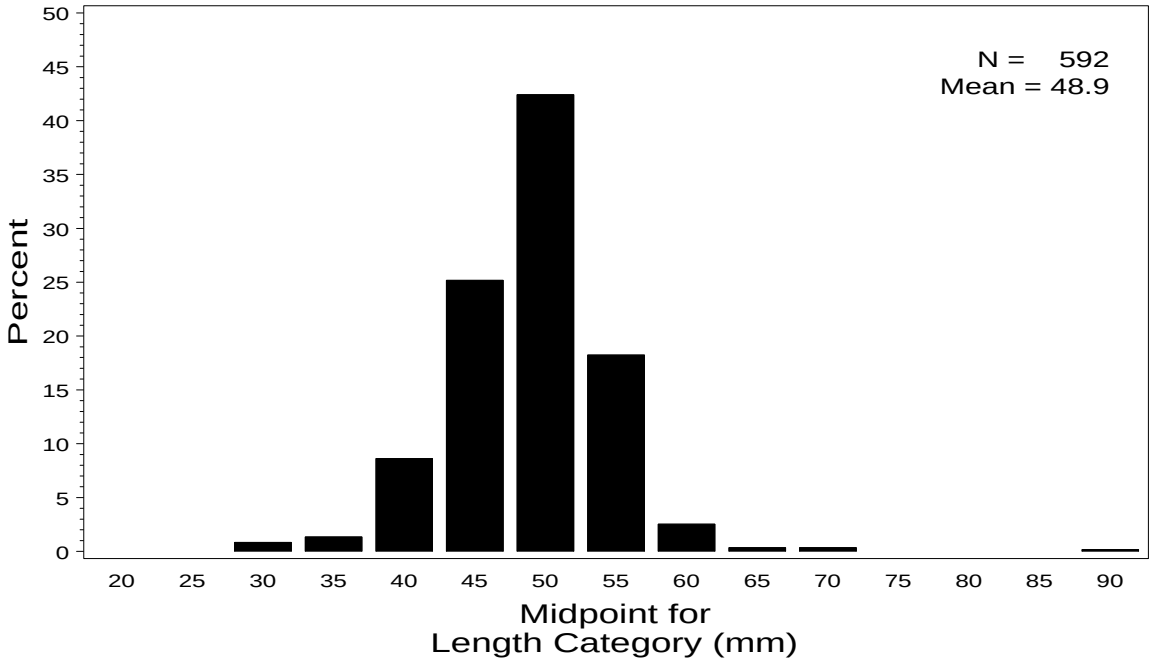


Figure 4-19. Estimated daily impingement of arrow goby based on the average impingement rate standardized by cooling water intake flow at MLPP Units 6&7 during the November 9, 2005–November 1, 2006 study.

a) Units 1&2



b) Units 6&7

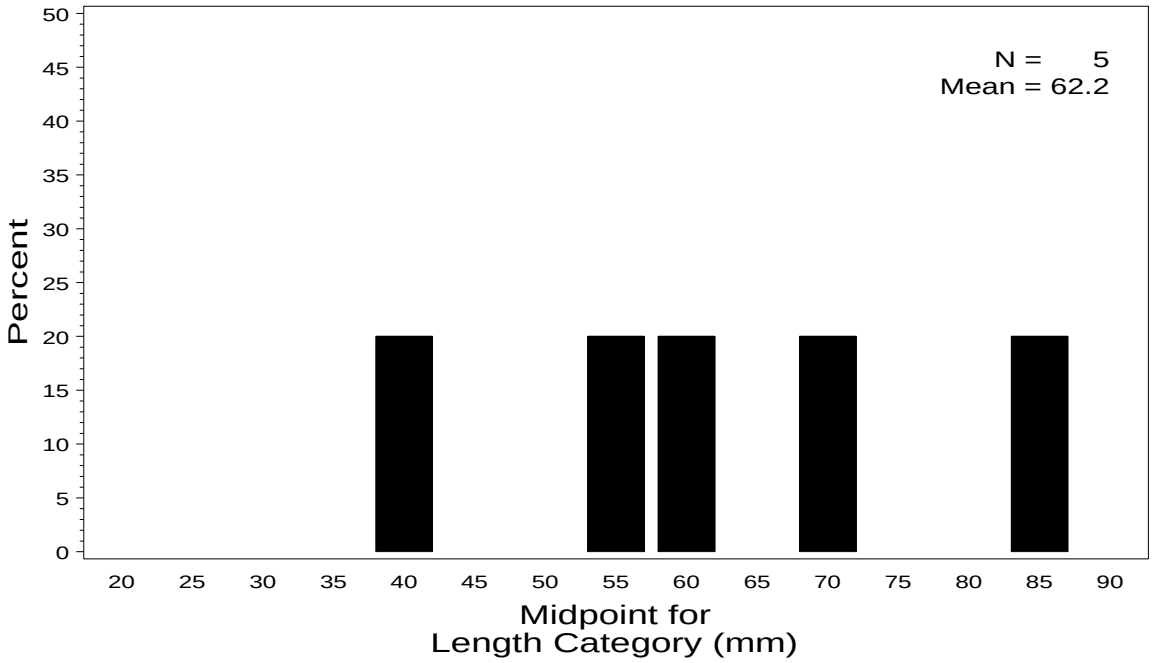


Figure 4-20. Length frequency distribution (mm SL) of arrow goby impinged at the Moss Landing Power Plant during the November 9, 2005–November 1, 2006 study.

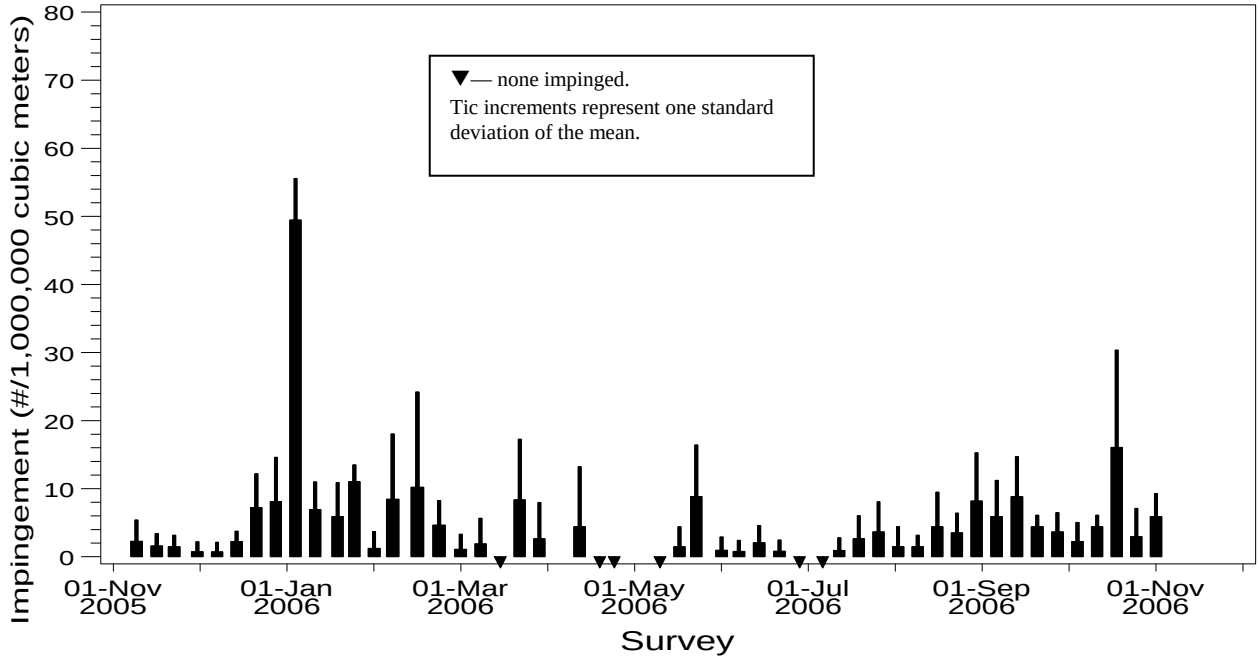
4.4.7 Threespine Sickleback Gasterosteus aculeatus

Threespine stickleback comprised 3.1 percent of the total number of fishes impinged at the Units 1&2 traveling screens during the November 1, 2005–November 9, 2006 MLPP impingement study (Figure 4-1). A total of 268 threespine stickleback weighing 0.2 kg (0.4 lb) were collected at the Units 1&2 traveling screens (Table 4-1). Threespine stickleback were collected in 44 of the 50 surveys (Figure 4-21). One threespine stickleback was collected from the Units 1&2 bar racks (Table 4-1).

Threespine stickleback comprised 0.9 percent of the total number of fishes impinged at the Units 6&7 traveling screens. A total of 186 threespine stickleback weighing 0.4 kg (1.0 lb) were collected at Units 6&7 (Table 4-1). Threespine stickleback were collected in all surveys (Figure 4-22).

A total of 258 threespine stickleback were measured from the impingement collections at the Units 1&2 traveling screens. They ranged from 19 to 74 mm SL (0.7 to 2.9 in.) with a mean of 35.7 mm SL (1.4 in.) (Figure 4-23a). A total of 115 threespine stickleback were measured from the impingement collections at the Units 6&7 intake. They ranged from 5 to 74 mm SL (0.2 to 2.9 in.) with a mean of 46.7 mm SL (1.8 in.) (Figure 4-23b).

a) Units 1&2 Abundance



b) Units 1&2 Biomass

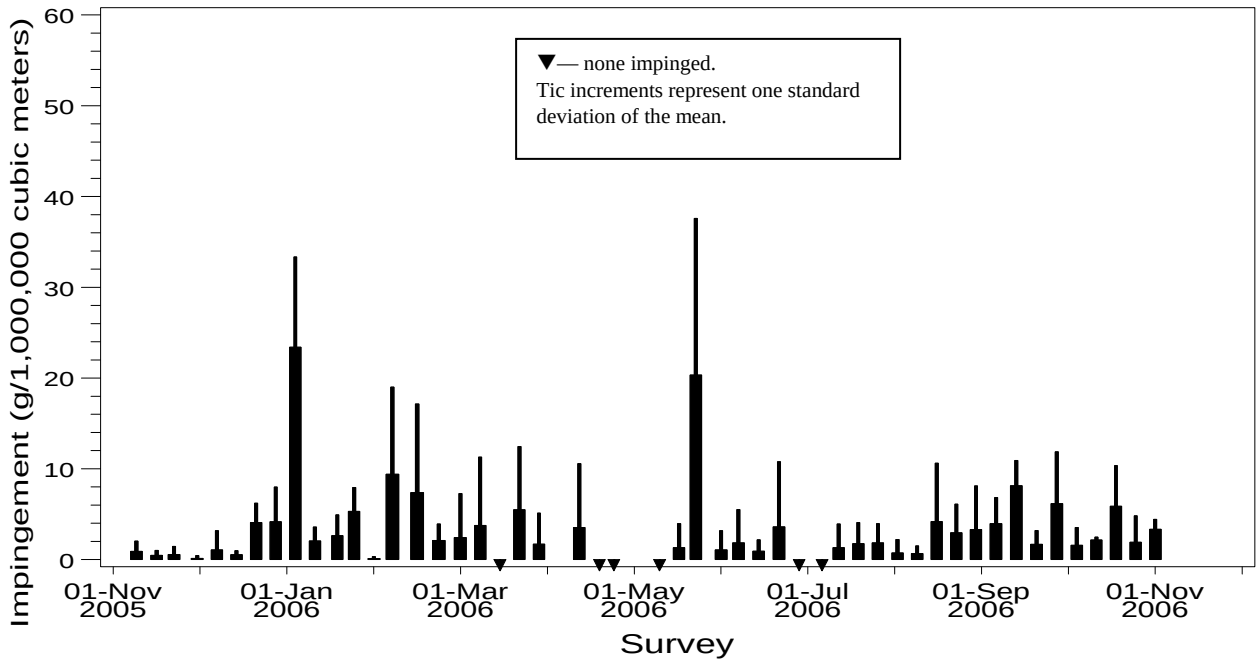
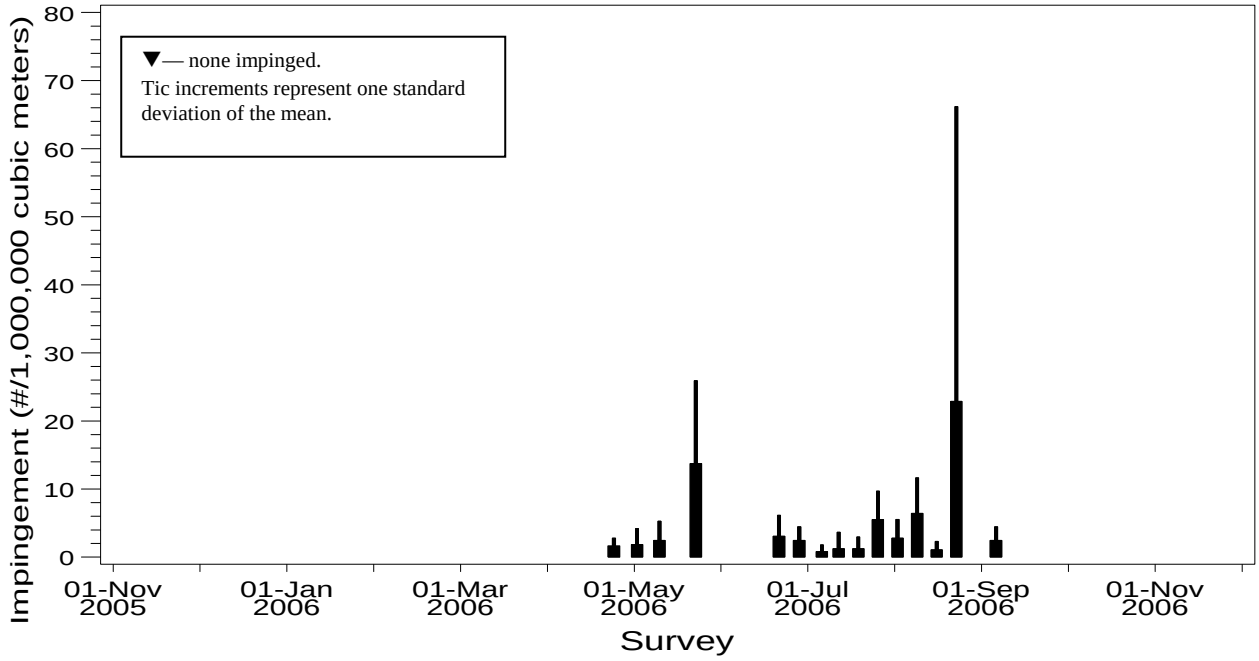


Figure 4-21. Estimated daily impingement of threespine stickleback based on the average impingement rate standardized by cooling water intake flow at MLPP Units 1&2 during the November 9, 2005–November 1, 2006 study.

a) Units 6&7 Abundance



b) Units 6&7 Biomass

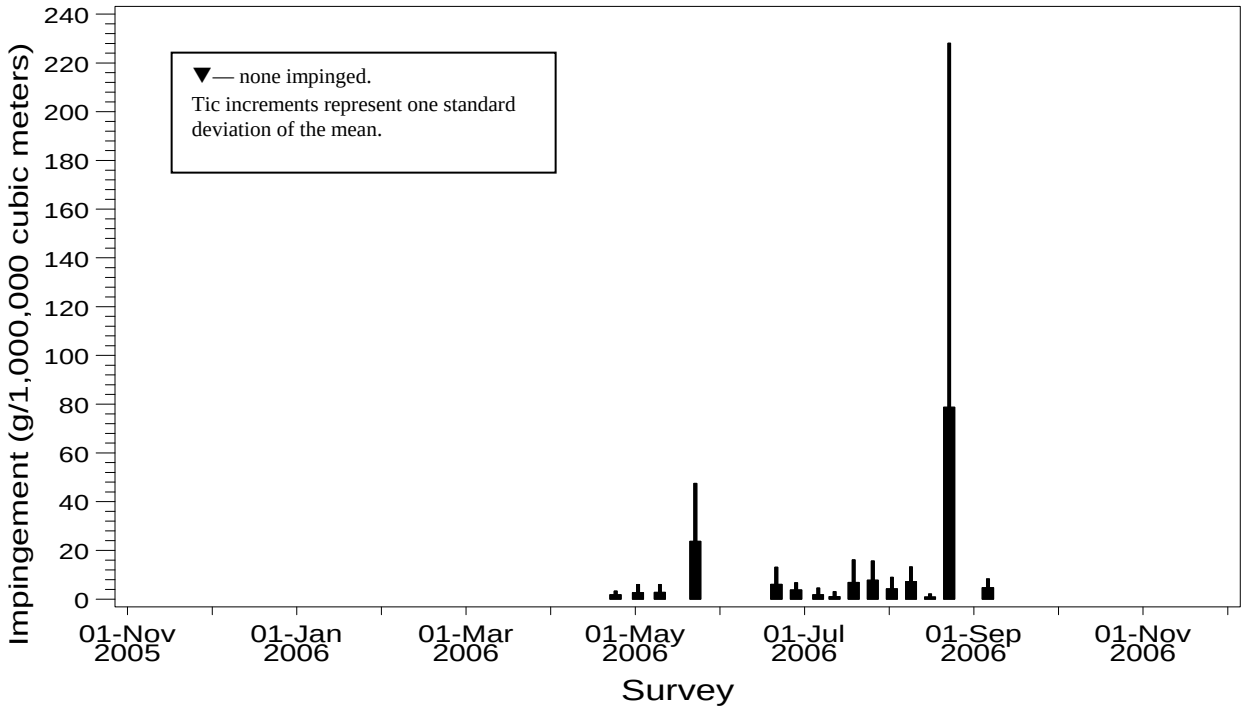
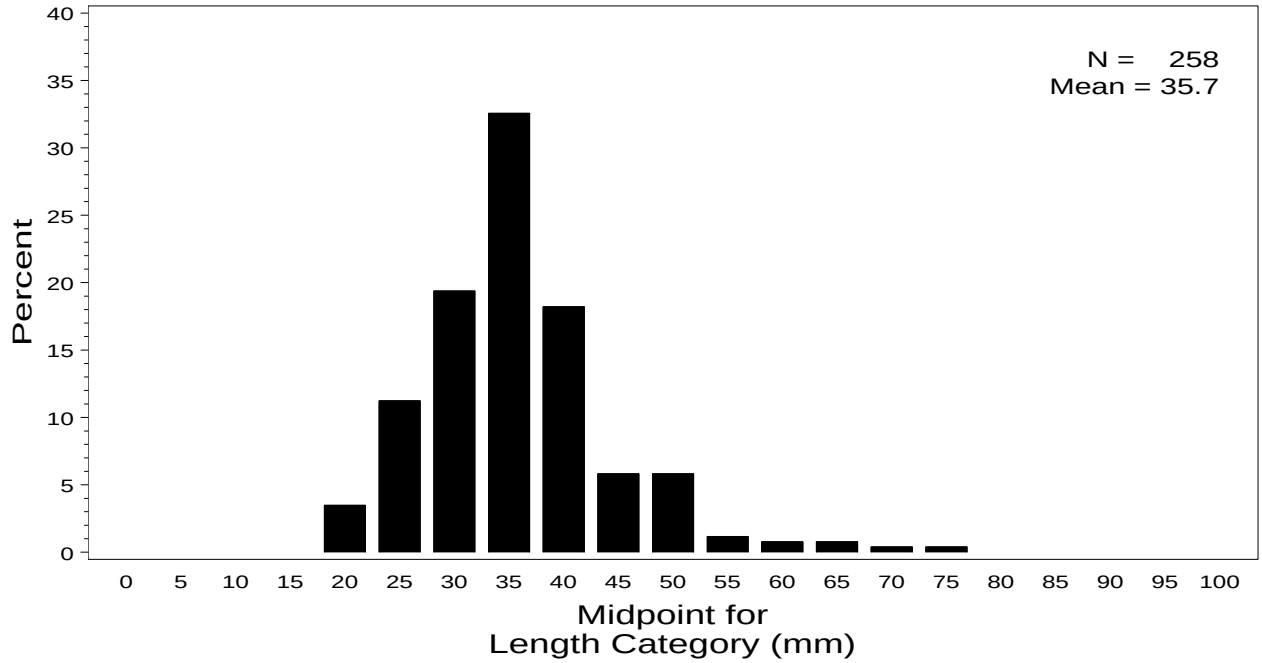


Figure 4-22. Estimated daily impingement of threespine stickleback based on the average impingement rate standardized by cooling water intake flow at MLPP Units 6&7 during the November 9, 2005–November 1, 2006 study.

a) Units 1&2



b) Units 6&7

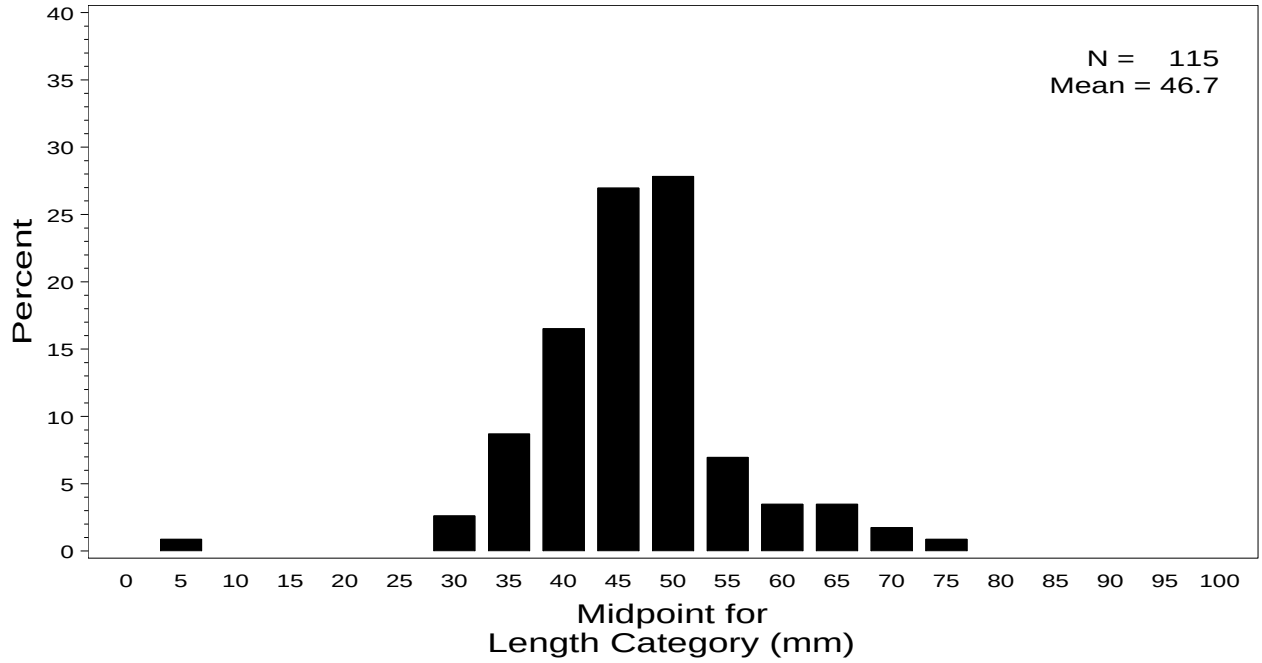


Figure 4-23. Length frequency distribution (mm SL) for threespine stickleback impinged at the Moss Landing Power Plant during the November 9, 2005–November 1, 2006 study.

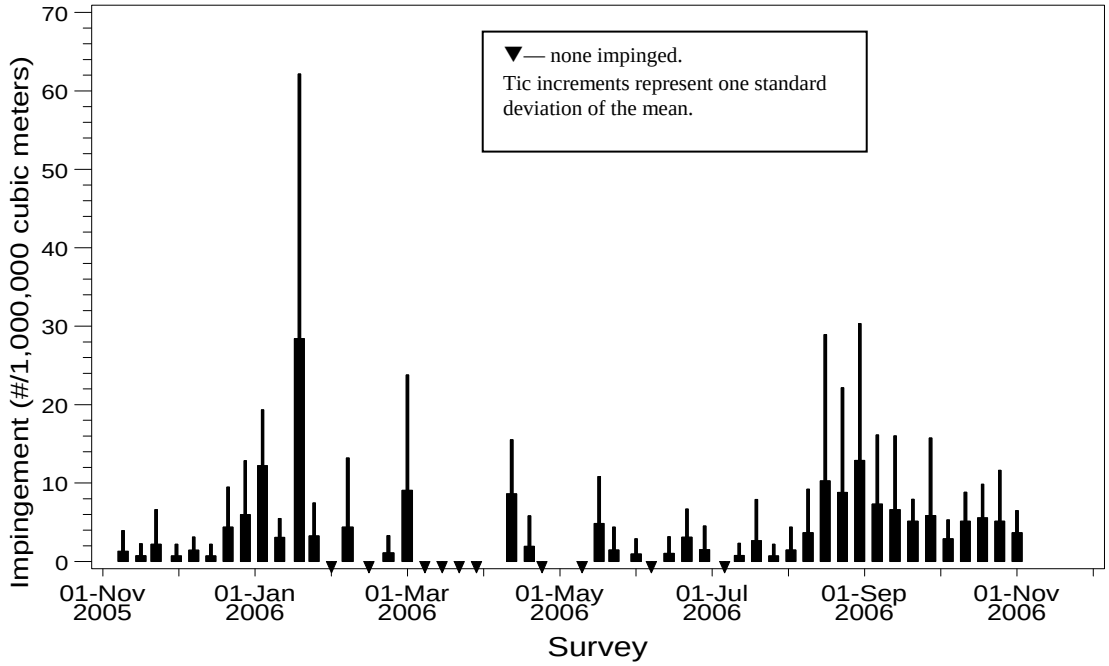
4.4.8 Bay Goby Lepidogobius lepidus

Bay goby comprised 2.5 percent of the total number of fishes impinged at the Units 1&2 traveling screens during the November 1, 2005–November 9, 2006 MLPP impingement study (Figure 4-1). A total of 212 bay goby weighing 1.2 kg (2.7 lb) were collected at the Units 1&2 traveling screens (Table 4-1). Bay goby were collected in 40 of the 50 surveys (Figure 4-24). No bay goby were collected from the Units 1&2 bar racks (Table 4-1).

Bay goby comprised less than 1 percent of the total number of fishes impinged at the Units 6&7 intake. A total of 140 bay goby weighing 0.9 kg (2.0 lb) were collected at Units 6&7 (Table 4-1). Bay goby were collected in 14 of the 15 surveys (Figure 4-25).

A total of 212 bay goby were measured from impingement collections at the Units 1&2 traveling screens. They ranged from 28 to 115 mm SL (1.1 to 4.5 in.) with a mean of 78.8 mm SL (3.1 in.) (Figure 4-26a). A total of 114 bay goby were measured from impingement collections at the Units 6&7 intake. They ranged from 69 to 97 mm SL (2.7 to 3.8 in.) with a mean of 85.6 mm SL (3.4 in.) (Figure 4-26b).

a) Units 1&2 Abundance



b) Units 1&2 Biomass

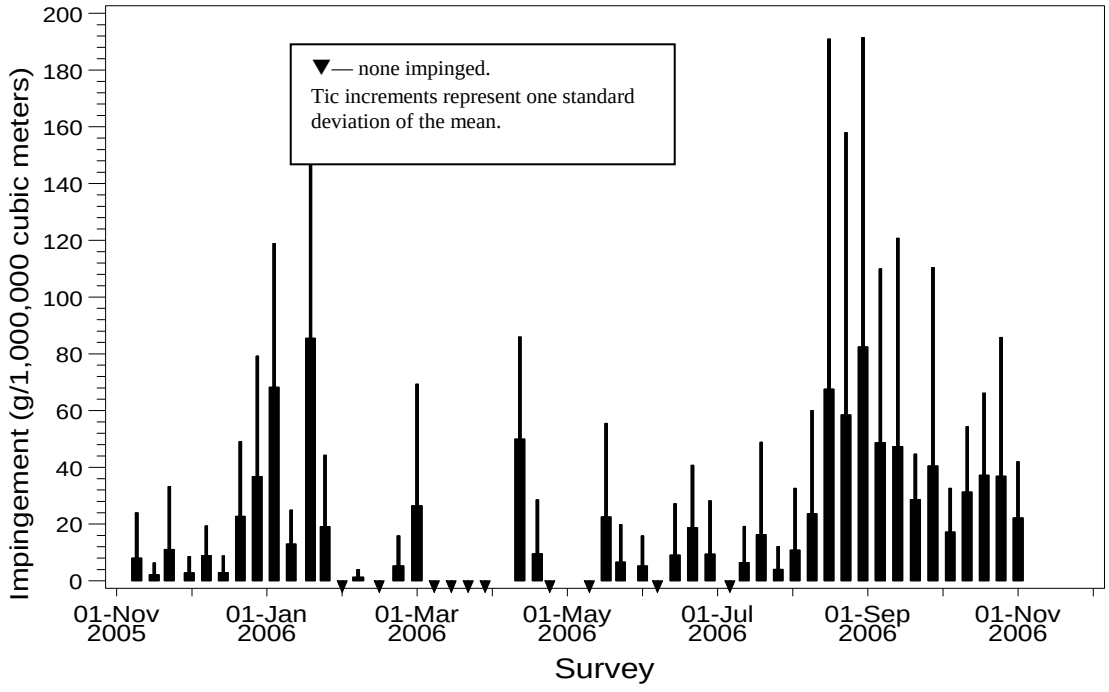
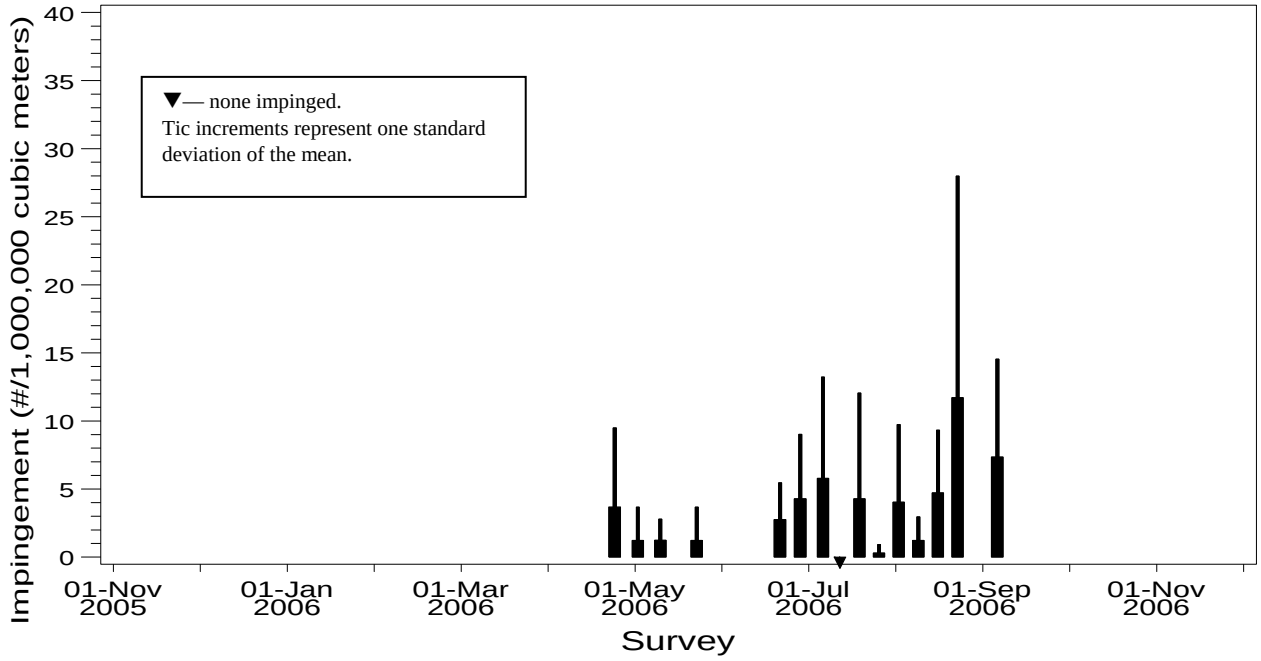


Figure 4-24. Estimated daily impingement of bay goby based on the average impingement rate standardized by cooling water intake flow at MLPP Units 1&2 during the November 9, 2005–November 1, 2006 study.

a) Units 6&7 Abundance



b) Units 6&7 Biomass

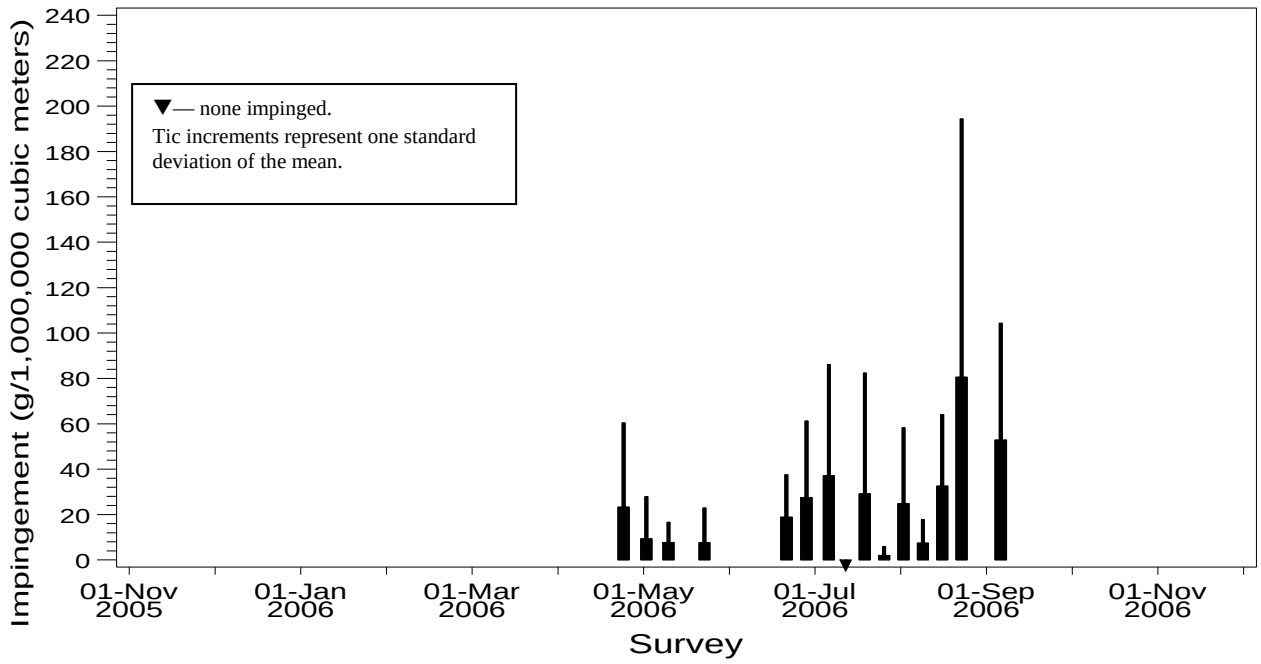
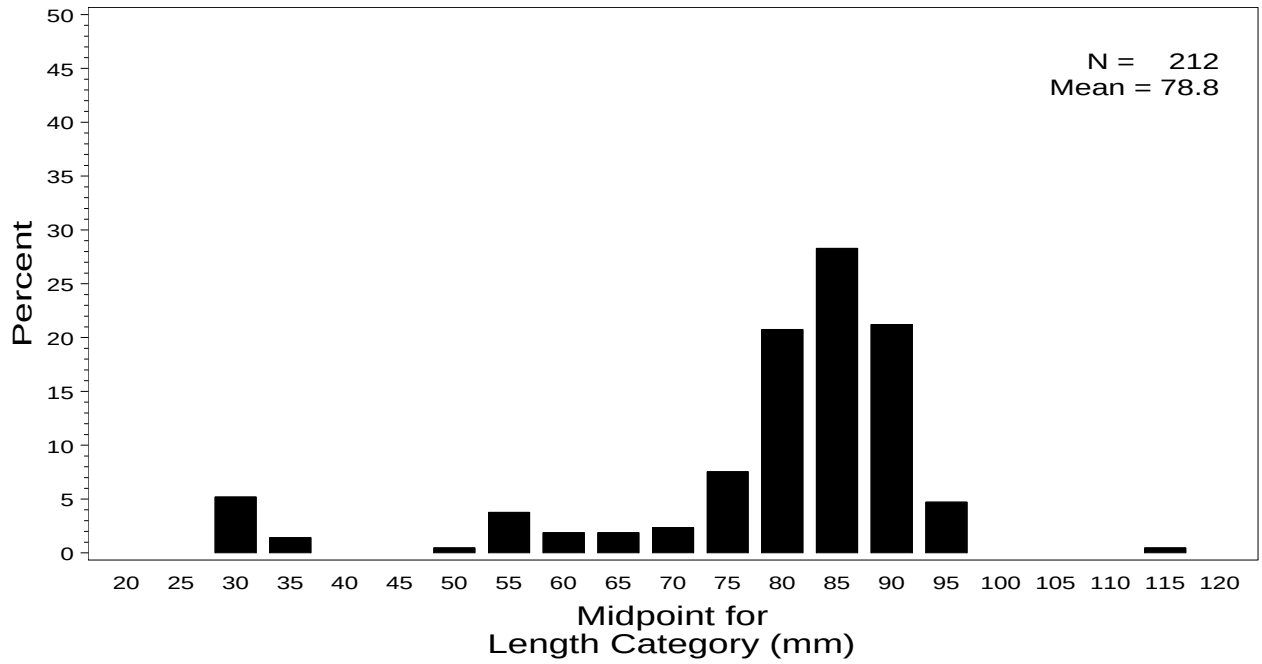


Figure 4-25. Estimated daily impingement of bay goby based on the average impingement rate standardized by cooling water intake flow at MLPP Units 6&7 during the November 9, 2005–November 1, 2006 study.

a) Units 1&2



b) Units 6&7

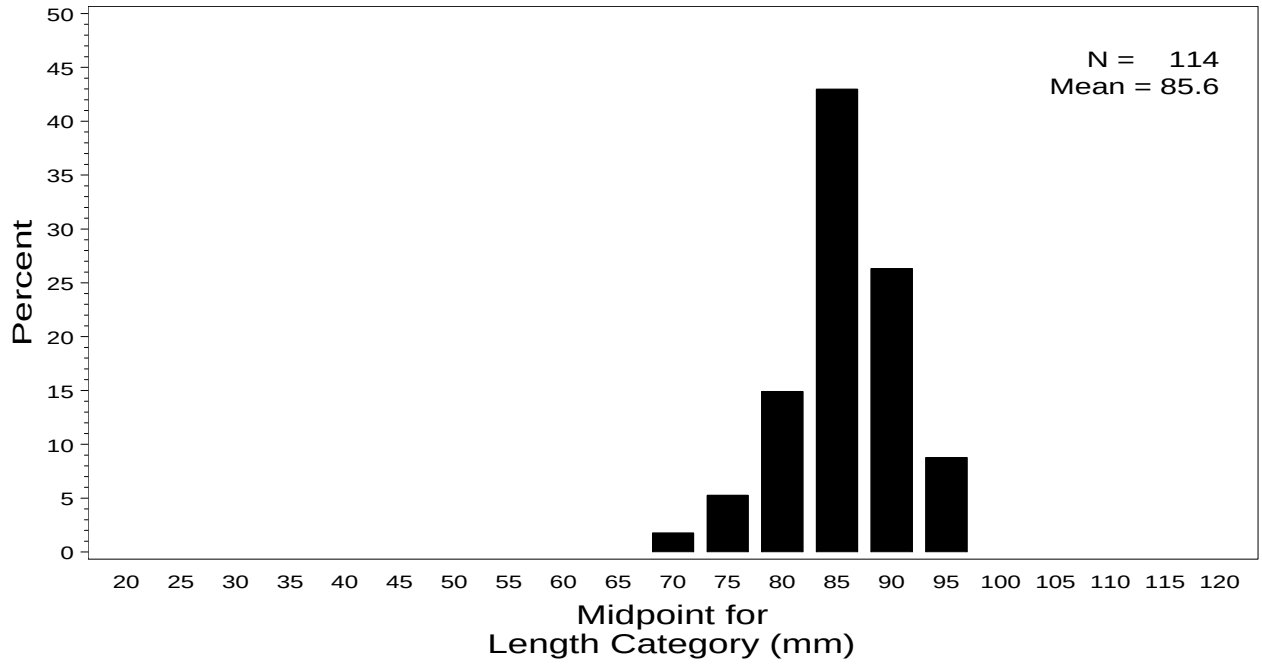


Figure 4-26. Length frequency distribution (mm SL) for bay goby impinged at the Moss Landing Power Plant during the November 9, 2005–November 1, 2006 study.

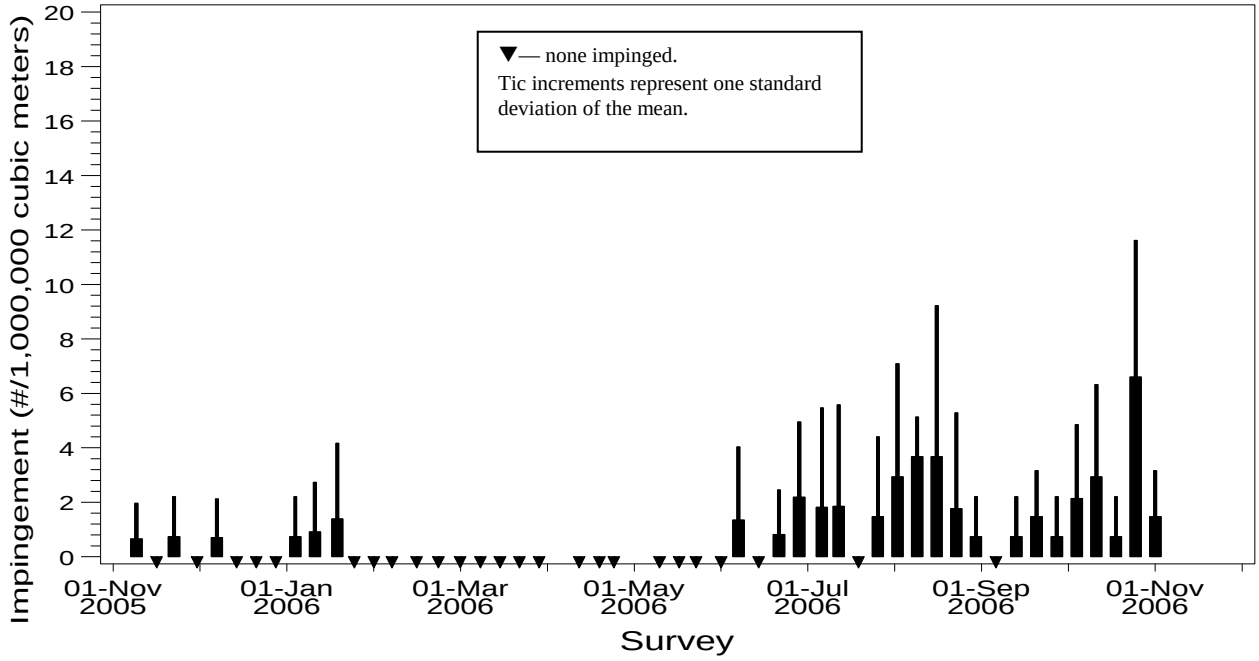
4.4.9 Shiner Surfperch Cymatogaster aggregata

Shiner surfperch comprised less than 1 percent of the total number of fishes impinged at the Units 1&2 traveling screens during the November 1, 2005–November 9, 2006 MLPP impingement study. A total of 57 shiner surfperch weighing 0.7 kg (1.5 lb) were collected at the Units 1&2 traveling screens (Table 4-1). Shiner surfperch were collected in 25 of the 50 surveys (Figure 4-27). One shiner surfperch was collected from the Units 1&2 bar racks (Table 4-1).

Shiner surfperch comprised 1.8 percent of the total number of fishes impinged at the Units 6&7 traveling screens (Figure 4-2). A total of 381 shiner surfperch weighing 2.6 kg (5.7 lb) were collected at Units 6&7 (Table 4-1). Shiner surfperch were collected in all 15 surveys (Figure 4-28).

A total of 53 shiner surfperch were measured from impingement collections at the Units 1&2 traveling screens. They ranged from 34 to 112 mm SL (1.3 to 4.4 in.) with a mean of 76.4 mm SL (3.0 in.) (Figure 4-29a). A total of 349 shiner surfperch were measured. They ranged from 31 to 124 mm SL (1.2 to 4.9 in.) with a mean of 58.0 mm SL (2.3 in.) (Figure 4-29b).

a) Units 1&2 Abundance



b) Units 1&2 Biomass

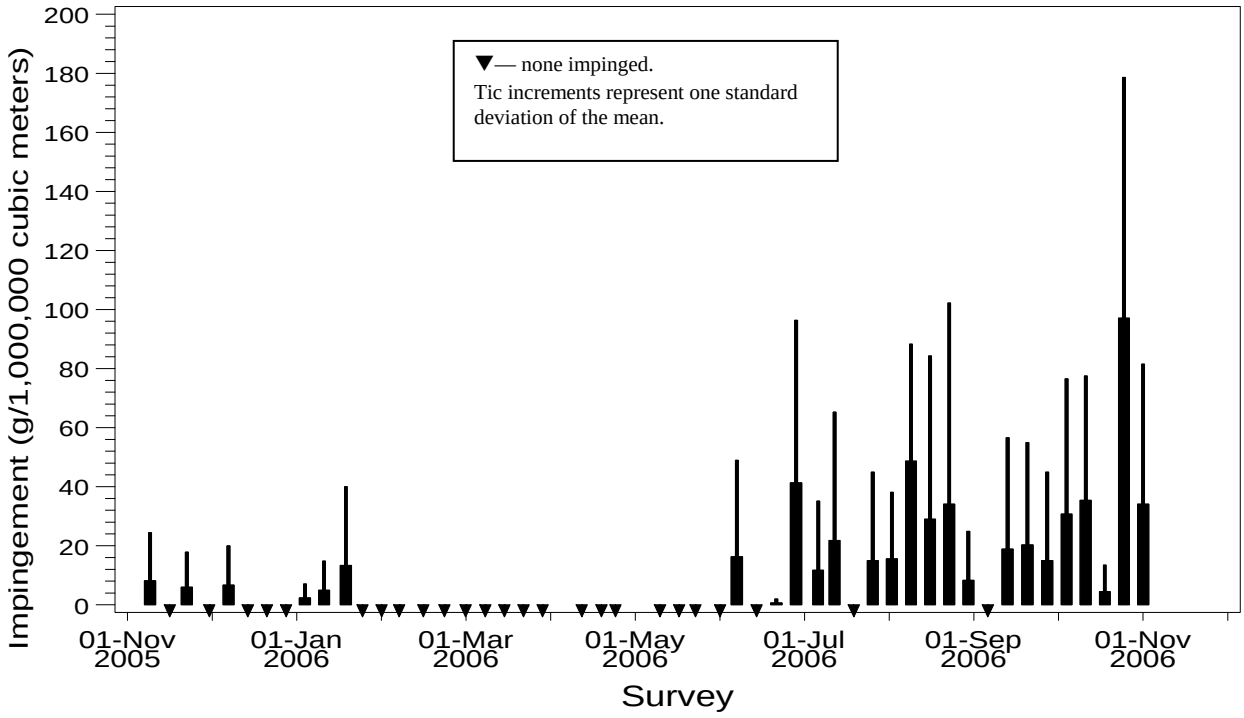
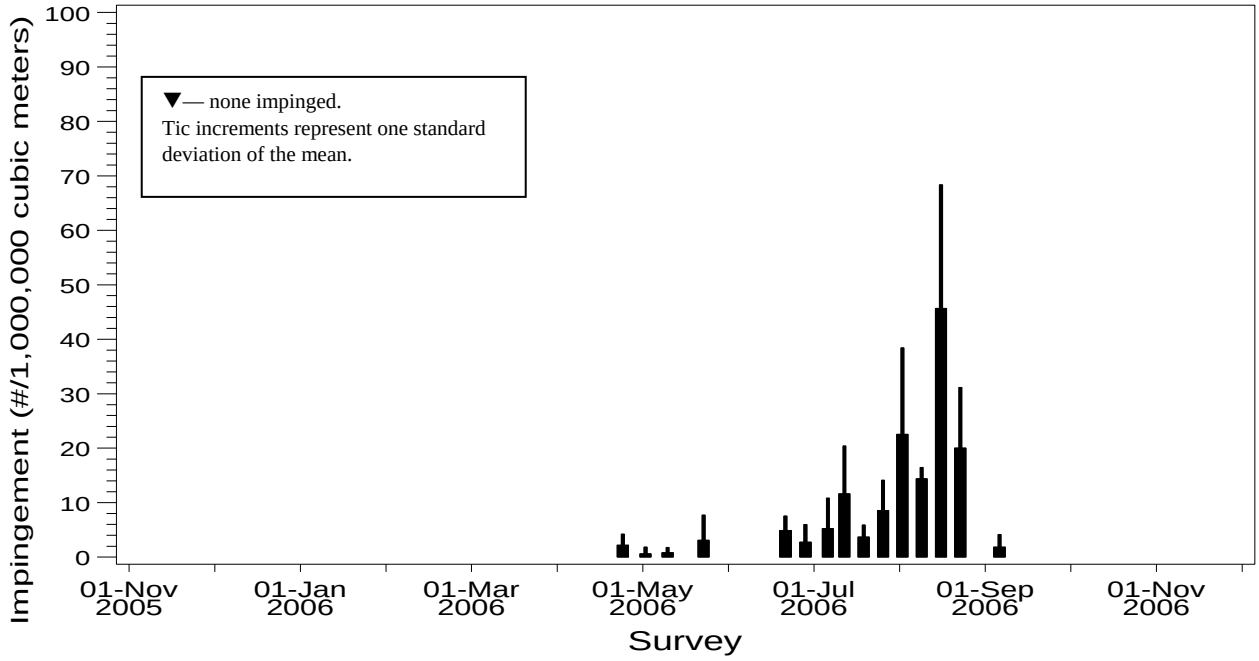


Figure 4-27. Estimated daily impingement of shiner surfperch based on the average impingement rate standardized by cooling water intake flow at MLPP Units 1&2 during the November 9, 2005–

November 1, 2006 study.

a) Units 6&7 Abundance



b) Units 6&7 Biomass

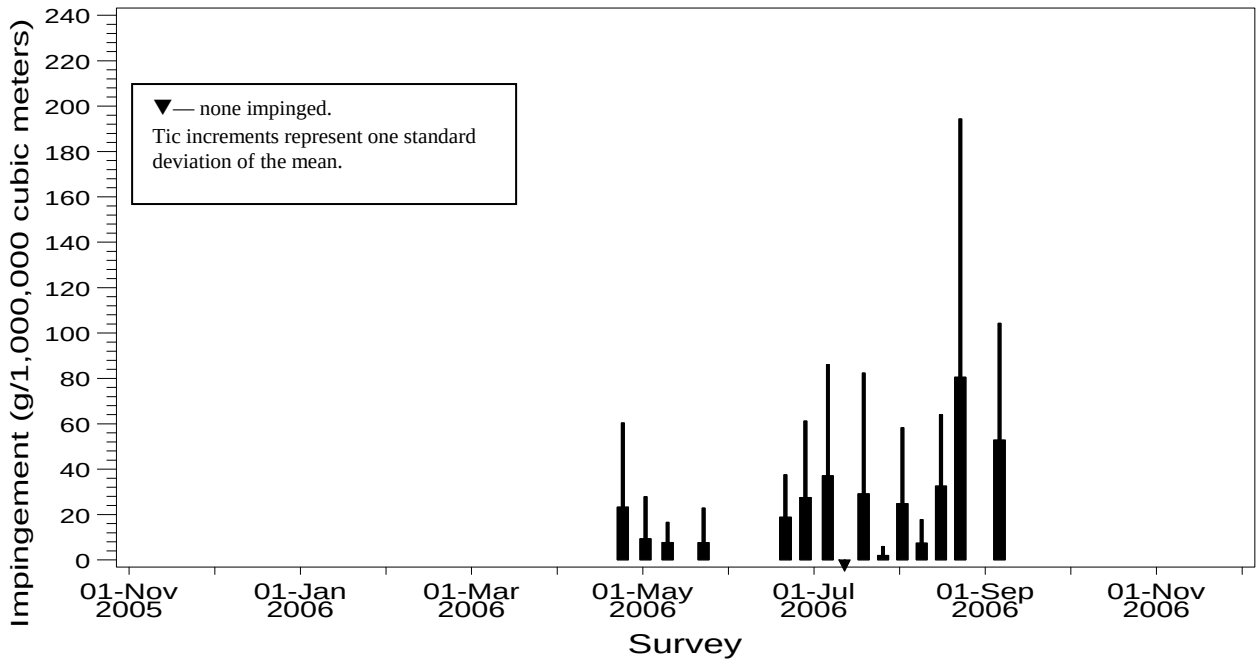
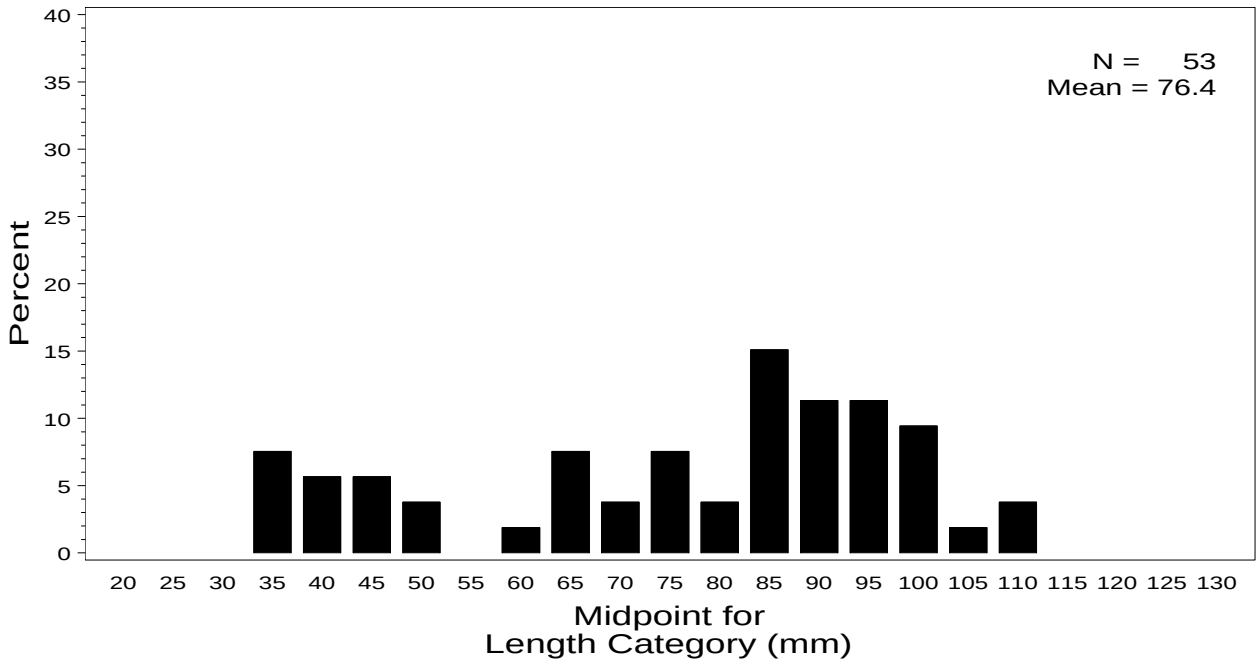


Figure 4-28. Estimated daily impingement of shiner surfperch based on the average impingement rate standardized by cooling water intake flow at MLPP Units 6&7 during the November 9, 2005–November 1, 2006 study.

a) Units 1&2



b) Units 6&7

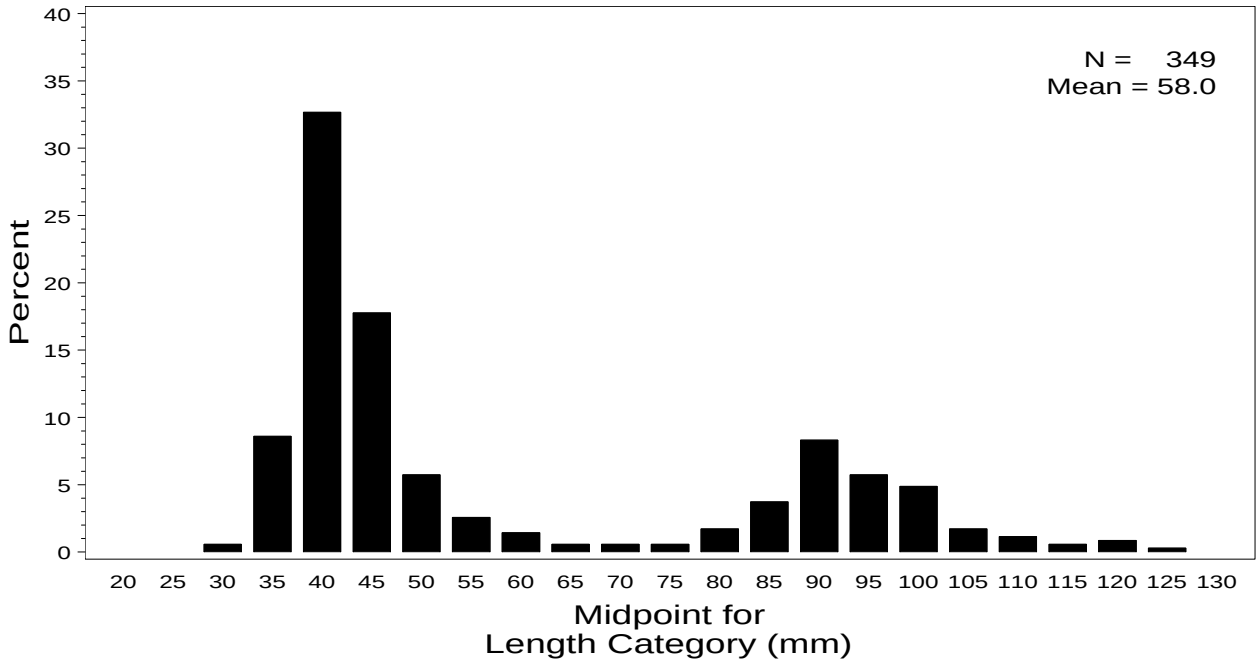


Figure 4-29. Length frequency distribution (mm SL) of shiner surfperch impinged at the Moss Landing Power Plant during the November 9, 2005–November 1, 2006 study.

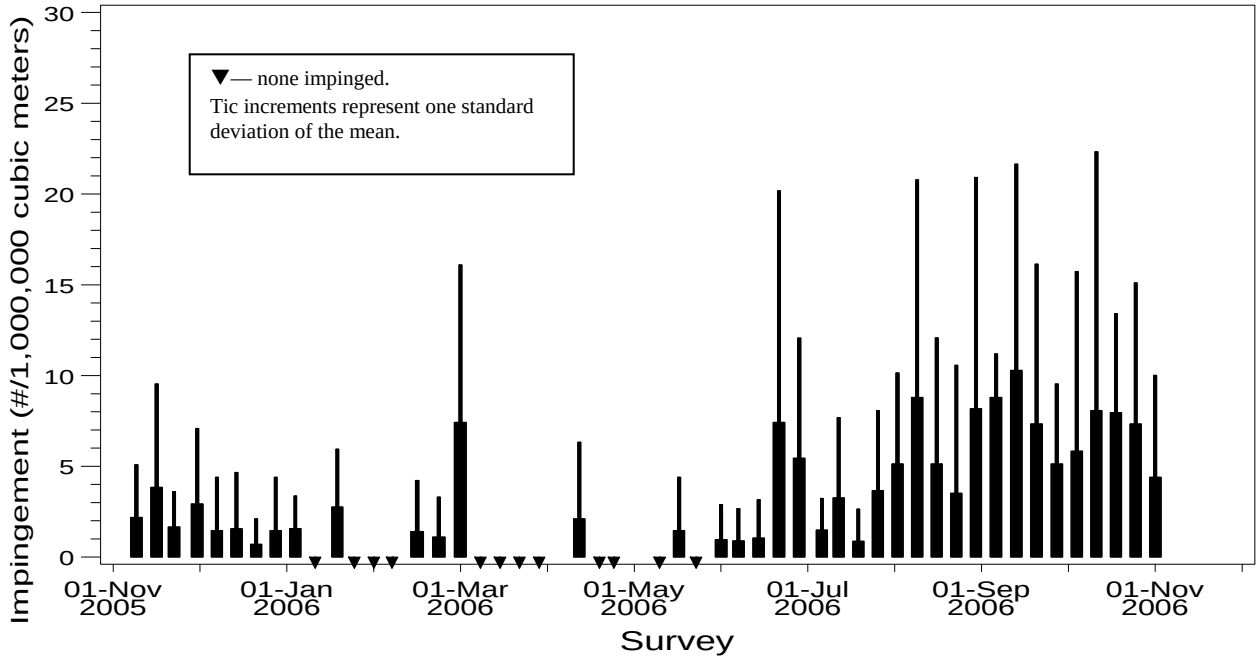
4.4.10 Pacific Staghorn Sculpin Leptocottus armatus

Pacific staghorn sculpin comprised 2.3 percent of the total number of fishes impinged at the Units 1&2 traveling screens during the November 1, 2005–November 9, 2006 MLPP impingement study. A total of 196 Pacific staghorn sculpin weighing 3.2 kg (7.0 lb) were collected at the Units 1&2 traveling screens (Table 4-1). Pacific staghorn sculpin were collected in 38 of the 50 surveys (Figure 4-30). No Pacific staghorn sculpin were collected from the Units 1&2 bar racks (Table 4-1).

Pacific staghorn sculpin comprised 1.7 percent of the total number of fishes impinged at the Units 6&7 traveling screens (Figure 4-2). A total of 360 Pacific staghorn sculpin weighing 4.8 kg (10.7 lb) were collected at Units 6&7 (Table 4-1). Pacific staghorn sculpin were collected in 14 out of the 15 surveys (Figure 4-31). Twenty-six percent of the Pacific staghorn sculpin impinged were on a single survey on July 6, 2006 (Appendix B).

A total of 193 Pacific staghorn sculpin were measured from impingement collections at the Units 1&2 traveling screens (Figure 4-32a). They ranged from 24 to 172 mm SL (0.9 to 6.8 in.) with a mean of 96.1 mm SL (3.8 in.). A total of 316 Pacific staghorn sculpin were measured from impingement collections at the Units 6&7 intake. They ranged from 40 to 132 mm SL (1.6 to 5.2 in.) with a mean of 88.9 mm SL (3.5 in.) (Figure 4-32b).

a) Units 1&2 Abundance



b) Units 1&2 Biomass

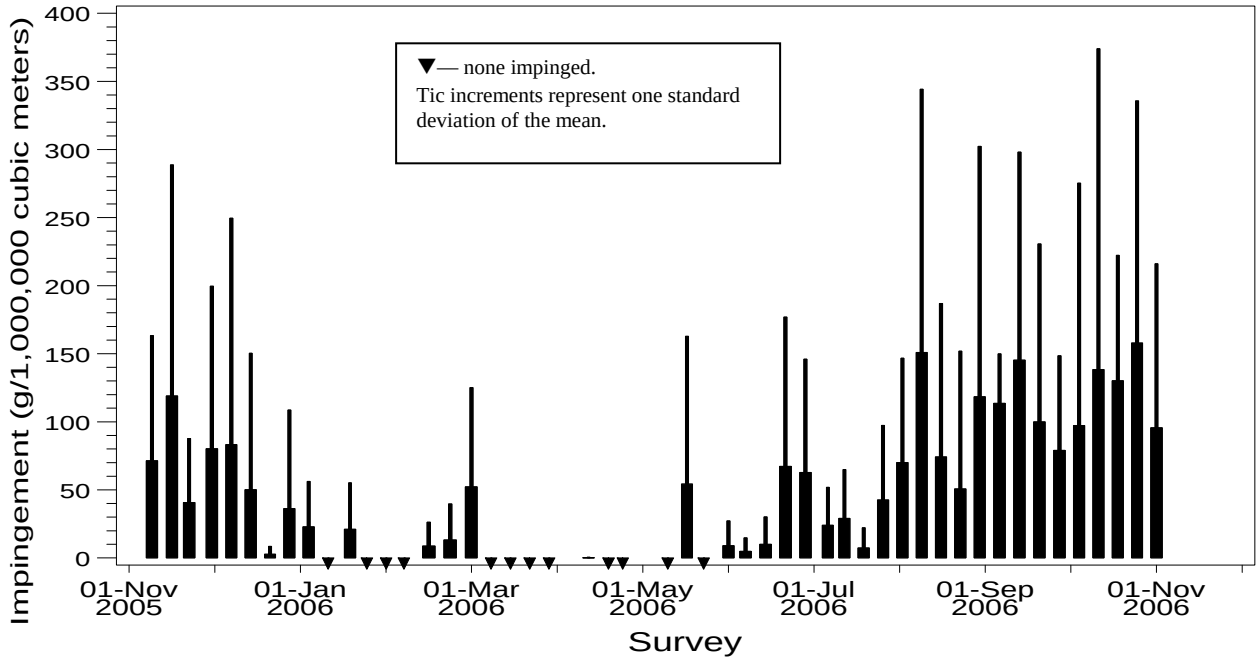
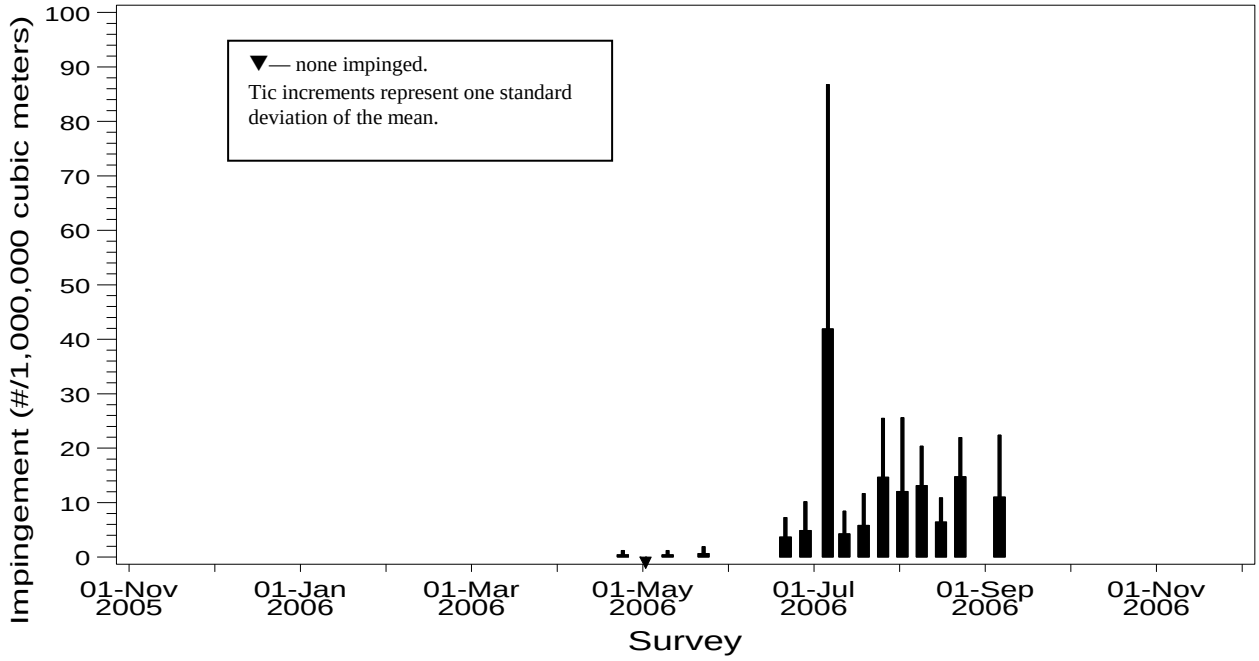


Figure 4-30. Estimated daily impingement of Pacific staghorn sculpin based on the average impingement rate standardized by cooling water intake flow at MLPP Units 1&2 during the November 9, 2005–November 1, 2006 study.

a) Units 6&7 Abundance



b) Units 6&7 Biomass

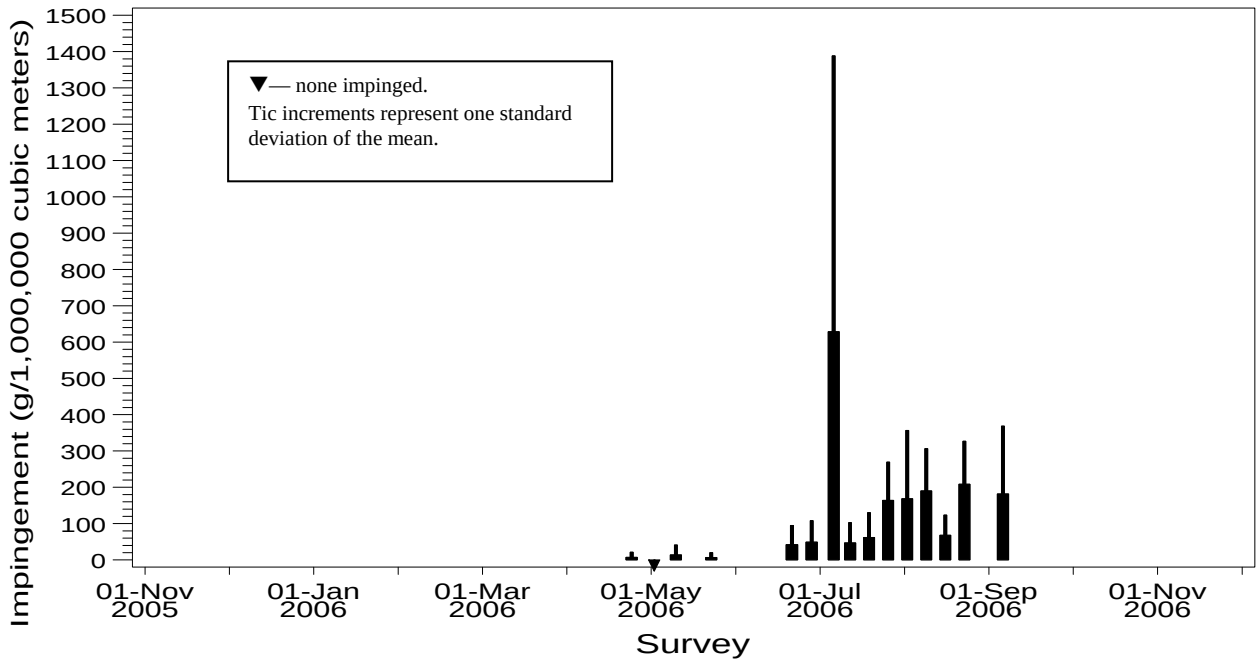
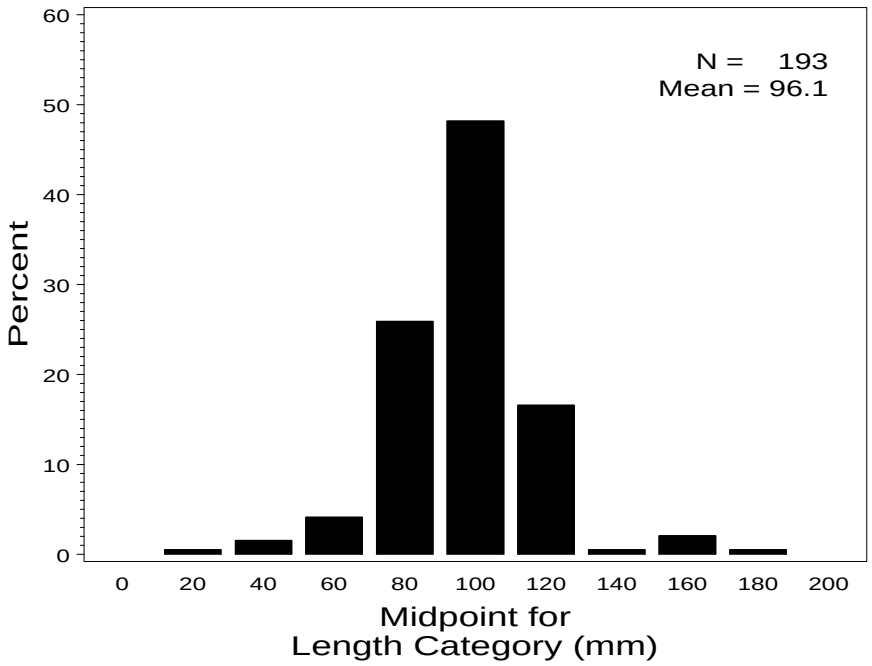


Figure 4-31. Estimated daily impingement of Pacific staghorn sculpin based on the average impingement rate standardized by cooling water intake flow at MLPP Units 6&7 during the November 9, 2005–November 1, 2006 study.

a) Units 1&2



b) Units 6&7

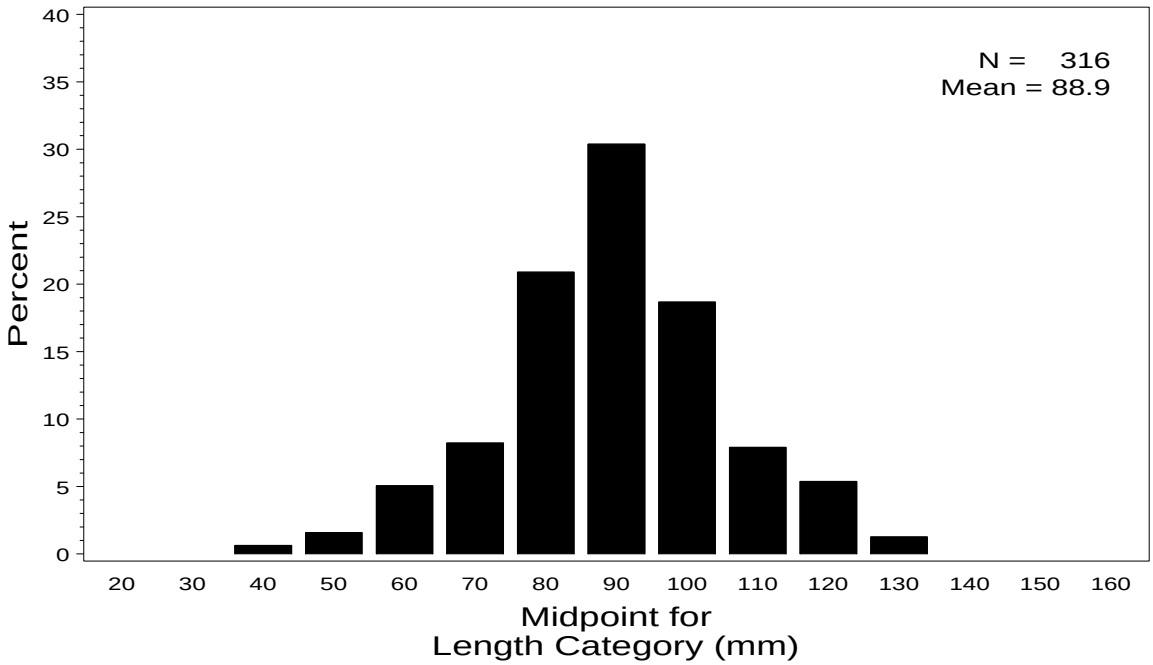


Figure 4-32. Length frequency distribution (mm SL) of Pacific staghorn sculpin impinged at MLPP during the November 9, 2005–November 1, 2006 study.

4.5 Overview of Results for Macroinvertebrates

Data provided in this section are from weekly 24-hour impingement collections beginning November 9, 2005 and continuing through November 1, 2006. A total of 50 surveys were conducted at the Units 1&2 intake during the year-long study (see Table 3-1). Impingement surveys were conducted at Units 6&7 intake when circulating water pumps were operating; 15 surveys were conducted from November 9, 2005 through November 1, 2006 (see Table 3-1).

4.5.1 Units 1&2

A total of 16,559 macroinvertebrates selected for analysis were collected from the Units 1&2 traveling screens and bar racks; 16,352 from the traveling screens and 207 from the bar racks (Table 4-1). Two taxa comprised 91.1 percent of the total number of selected macroinvertebrates impinged on the Units 1&2 traveling screens (Figure 4-33). Of the macroinvertebrates selected for analysis, *Crangon* spp. shrimps were the most abundant (86.2 percent), followed by *Cancer* spp. crabs (4.9 percent) (Figure 4-33).

Four species of bay shrimp and a group of bay shrimps that could not be identified to species were impinged on the traveling screens at Units 1&2. Of the total number of bay shrimps impinged, the largest percentage (48 percent) were individuals that could not be identified to species, followed by spotted bay shrimp *Crangon nigromaculata* (35 percent), Franciscan bay shrimp *Crangon franciscorum* (9 percent), black-tailed bay shrimp *Crangon nigricauda* (8 percent), and northern crangon *Crangon alaskensis* (<1 percent).

Six species of Cancer crabs and a group of Cancer crabs that could not be identified to species were collected. Of the total number of *Cancer* spp. crabs impinged, the largest percentage was represented by hairy rock crab *Cancer jordani* (34 percent), followed by brown rock crab *Cancer antennaruis* (26 percent), red rock crab *Cancer productus* (23 percent), a group of *Cancer* spp. that could not be identified to species (10 percent), slender crab *Cancer gracilis* (3 percent), Dungeness crab *Cancer magister* (2 percent), yellow crab *Cancer anthonyi* (2 percent).

Two species comprised approximately 83 percent of the total number of macroinvertebrates collected at the Units 1&2 bar racks (kelp crabs *Pugettia* spp. [62 percent] and *Cancer* spp. crabs [21 percent]).

The total weight of the macroinvertebrates selected for analysis that were impinged on the traveling screens and bar racks was 38.5 kg (85 lb) and 3.7 kg (8 lb), respectively (Table 4-1). Three taxa comprised 90.1 percent of the total biomass impinged at the Units 1&2 traveling screens (Figure 4-33). Bay shrimps *Crangon* spp. accounted for the highest biomass

(44.4 percent), followed by *Cancer* spp. crabs (37.4 percent), and kelp crabs *Pugettia* spp. (8.3 percent) (Figure 4-33).

4.5.2 Units 6&7

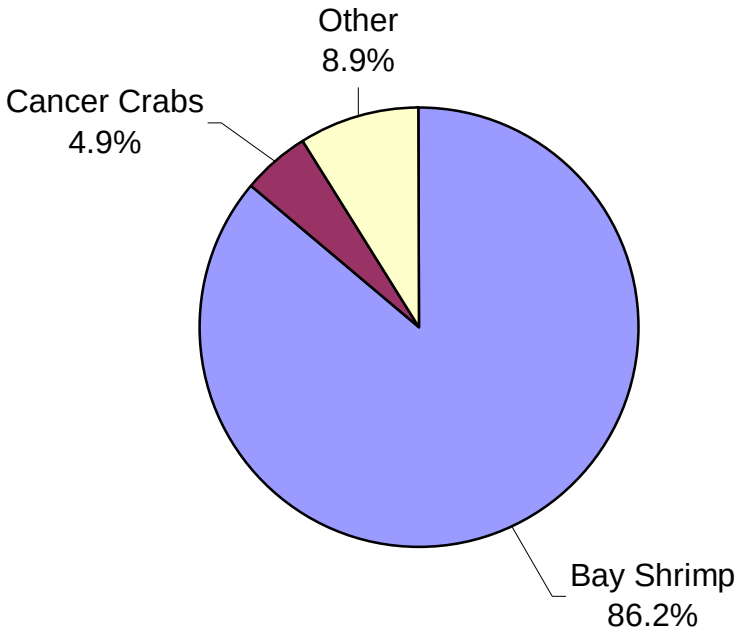
A total of 5,014 macroinvertebrates selected for analysis were collected from the Units 6&7 traveling screens (Table 4-1). Two species comprised 93.8 percent of the total number of selected macroinvertebrates impinged on the Units 1&2 traveling screens. Bay shrimps *Crangon* spp. were the most abundantly collected macroinvertebrate (90.1 percent), followed by *Cancer* spp. crabs (3.7 percent) (Figure 4-34).

The largest percentage of bay shrimps were individuals that could not be identified to species (84 percent), followed by spotted bay shrimp *Crangon nigromaculata* (15 percent), black-tailed bay shrimp *Crangon nigricauda* (<1 percent), and Franciscan bay shrimp *Crangon franciscorum* (<0.1 percent).

Six species of Cancer crabs and a group of Cancer crabs that could not be identified to species were collected. Of the total number of *Cancer* spp. crabs impinged, the largest percentage was represented by Dungeness crab *Cancer magister* (37 percent), followed by red rock crab *Cancer productus* (29 percent), brown rock crab *Cancer antennaruis* (12 percent), hairy rock crab *Cancer jordani* (8 percent), a group of *Cancer* spp. that could not be identified to species (7 percent), slender crab *Cancer gracilis* (6 percent), and yellow crab *Cancer anthonyi* (1 percent).

The total weight of impinged macroinvertebrates selected for analysis was 20 kg (44 lb) (Table 4-1). Three taxa comprised 95.9 percent of the total biomass impinged at the Units 1&2 traveling screens. *Cancer* spp. crabs accounted for the highest biomass (53.4 percent), followed by bay shrimp *Crangon* spp. shrimps (28.6 percent), and kelp crabs (13.9 percent).

a) Units 1&2 Count



b) Units 1&2 Biomass

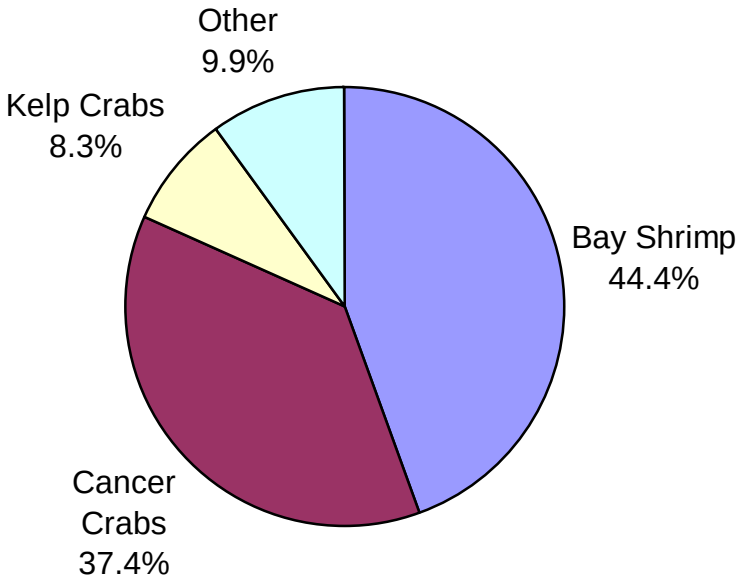
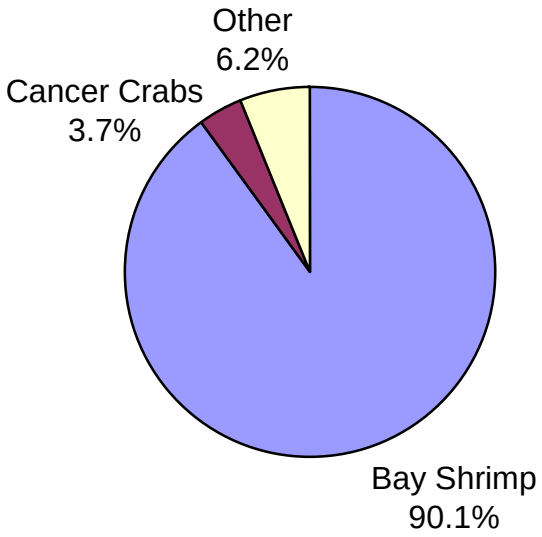


Figure 4-33. Percent taxonomic composition of macroinvertebrates selected for analysis impinged at the Moss Landing Power Plant Units 1&2 traveling screens determined by a) total number impinged and b) biomass impinged (g).

a) Units 6&7 Count



b) Units 6&7 Biomass

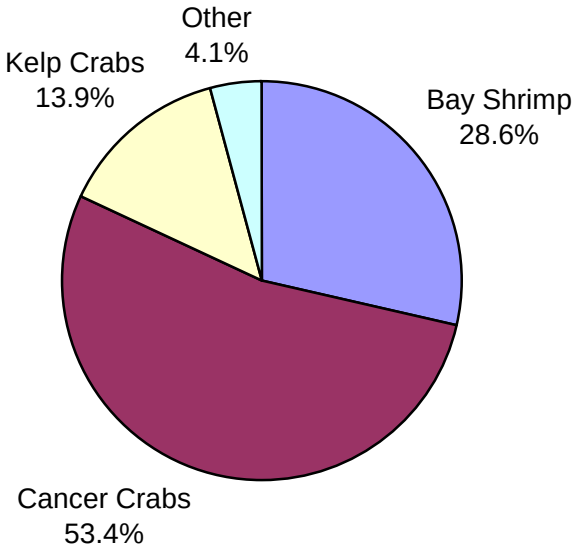


Figure 4-34. Percent taxonomic composition of macroinvertebrates selected for analysis impinged at the Moss Landing Power Plant Units 6&7 traveling screens determined by a) total number impinged and b) biomass impinged (g).

4.5.3 Bay Shrimp Crangon spp.

Bay shrimp comprised 86.2 percent of the total number of macroinvertebrates impinged at the Units 1&2 traveling screens during the November 1, 2005–November 9, 2006 MLPP impingement study (Figure 4-33). A total of 14,095 bay shrimp weighing 17 kg (37 lb) were collected at the Units 1&2 traveling screens (Table 4-1). Bay shrimps were by far the largest group of invertebrates collected by number and biomass. Collection rose sharply in the month of January, accounting for 60 percent of the individuals from Units 1&2. Collection also increased, though less sharply, from late June to mid September, accounting for 27 percent of the Units 1&2 totals collectively. Bay shrimps were collected in 48 of the 50 surveys (Figure 4-35). Fourteen bay shrimp were collected from the Units 1&2 bar racks (Table 4-1).

A summary of the range of lengths (mm) and the mean length (mm) for each species of bay shrimp impinged at Units 1&2 is provided in Table 4-2. Bay shrimps were measured from the tip of the rostrum to the posterior edge of the carapace.

Table 4-2. Summary of the range of lengths (mm) and mean length (mm) for each species of bay shrimp impinged at MLPP Units 1&2 during the November 9, 2005–November 1, 2006 study.

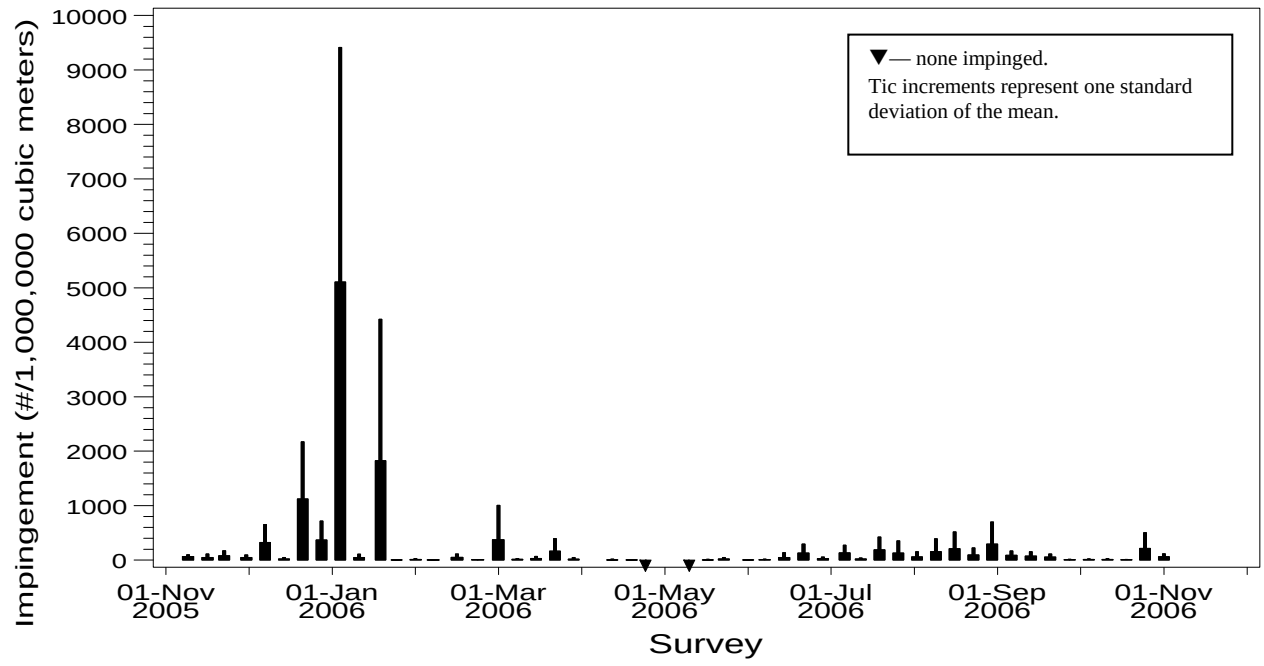
Species	Number Measured	Length range (mm)	Mean Length
Spotted bay shrimp *Crangon nigromaculata*	835	4 to 18	11.0
Black-tailed bay shrimp *Crangon nigricauda*	620	4 to 17	10.9
Franciscan bay shrimp *Crangon franciscorum*	457	5 to 20	13.7
Northern crangon *Crangon alaskensis*	48	6 to 20	11.1

Bay shrimps comprised 90.1 percent of the total number of macroinvertebrates impinged at the Units 6&7 traveling screens (Figure 4-34). A total of 4,520 bay shrimps weighing 5.7 kg (12.6 lb) were collected at Units 6&7 (Table 4-1). Bay shrimps were collected in all 15 surveys (Figure 4-36). A summary of the range of lengths (mm) and the mean length (mm) for each species of bay shrimp impinged at Units 6&7 is provided in Table 4-3.

Table 4-3. Summary of the range of lengths (mm) and mean length (mm) for each species of bay shrimp impinged at MLPP Units 6&7 during the November 9, 2005–November 1, 2006 study.

Species	Number Measured	Length range (mm)	Mean Length
Spotted bay shrimp *Crangon nigromaculata*	231	5 to 19	10.5
Black-tailed bay shrimp *Crangon nigricauda*	42	4 to 12	8.3
Franciscan bay shrimp *Crangon franciscorum*	17	6 to 16	11.6

a) Units 1&2 Abundance



b) Units 1&2 Biomass

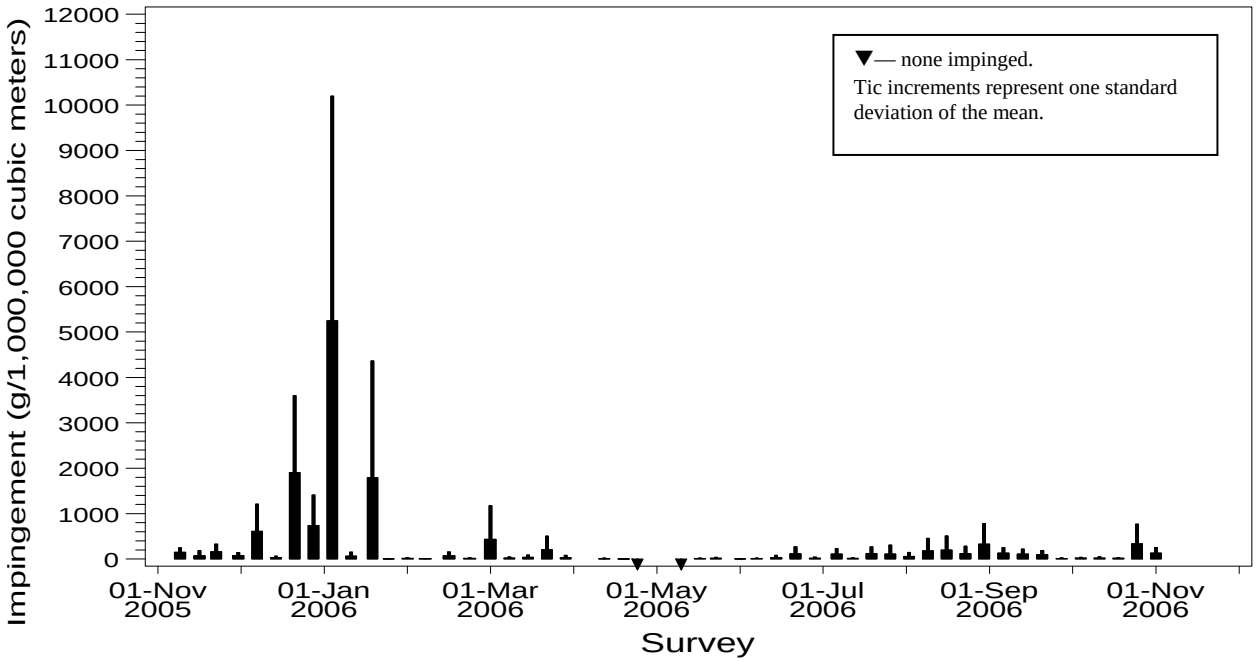
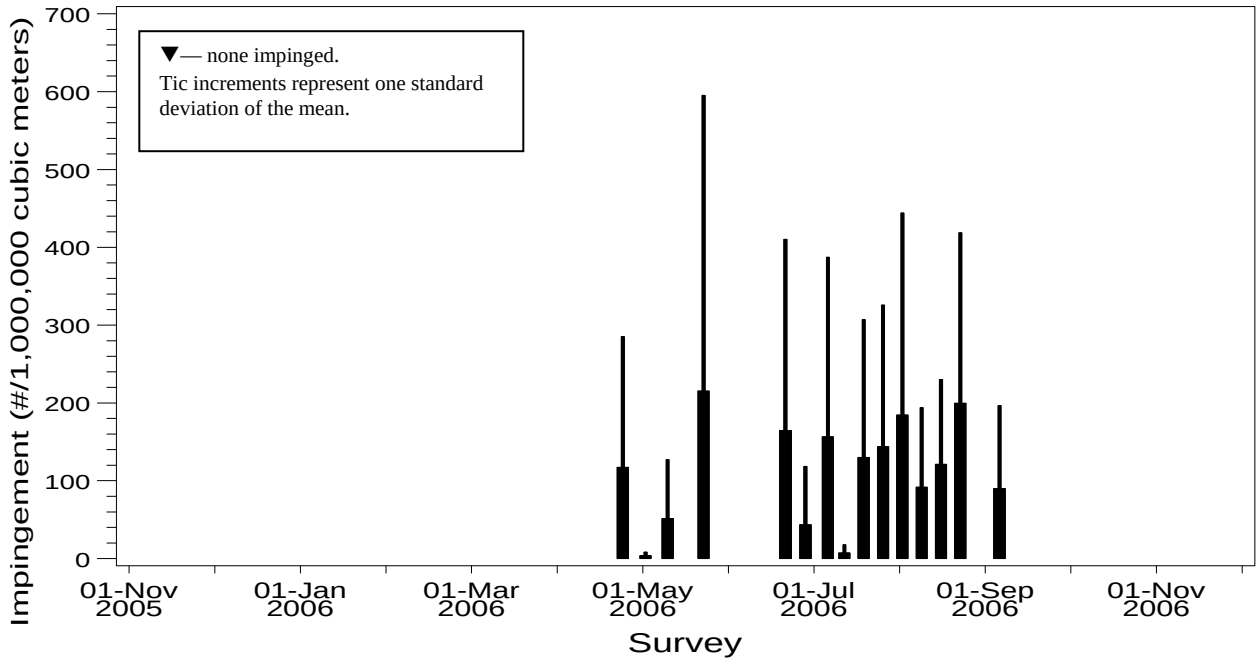


Figure 4-35. Estimated daily impingement of *Crangon* spp. based on the average impingement rate standardized by cooling water intake flow at the MLPP Units 1&2 during the November 9, 2005–November 1, 2006 study.

a) Units 6&7 Abundance



b) Units 6&7 Biomass

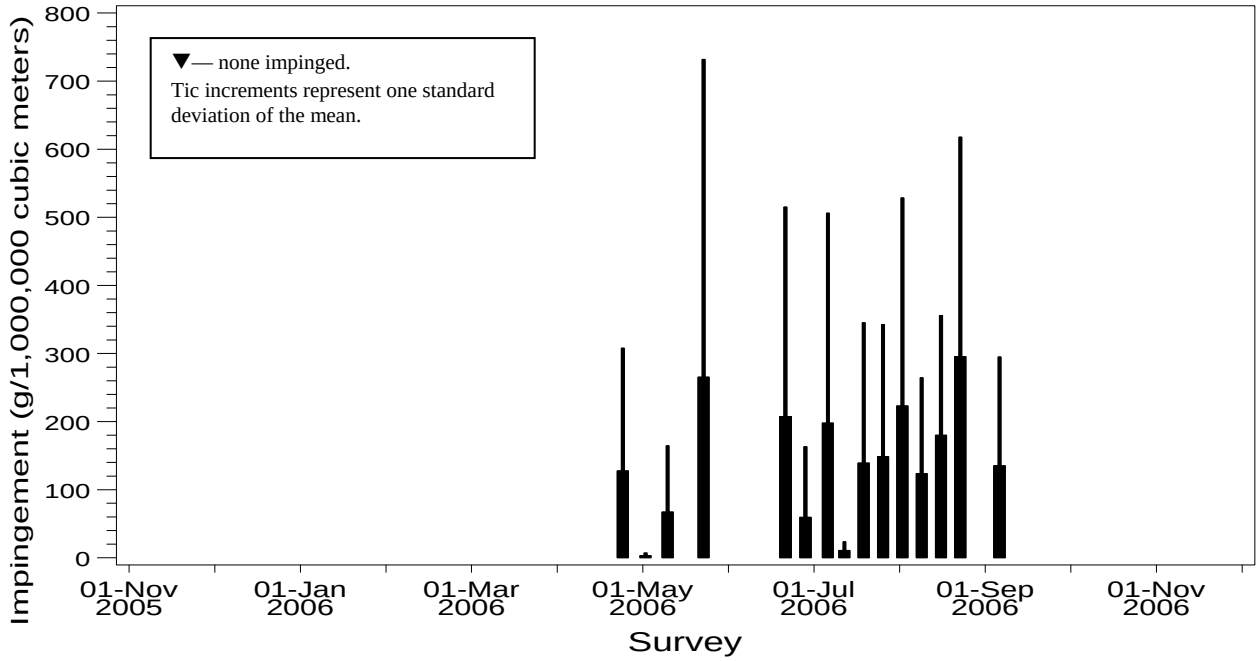


Figure 4-36. Estimated daily impingement of *Crangon* spp. based on the average impingement rate standardized by cooling water intake flow at the MLPP Units 6&7 during the November 9, 2005–November 1, 2006 study.

4.5.4 Rock crabs Cancer spp.

Rock crabs comprised 4.9 percent of the total number of macroinvertebrates impinged at the Units 1&2 traveling screens during the November 1, 2005–November 9, 2006 MLPP impingement study (Figure 4-33). A total of 798 rock crabs weighing 14.3 kg (32 lb) were collected at the Units 1&2 traveling screens (Table 4-1). Rock crabs are the second most abundant group of invertebrates collected by number and biomass. Rock crabs account for 5 percent of the number of individuals collected but account for 42 percent of the biomass. Rock crabs reached their highest abundances in March/April (Figure 4-37). Rock crabs were collected in 48 of the 50 surveys (Figure 4-37). Forty-four rock crabs (approximately 9 percent of Units 1&2 biomass) were collected from the Unit 1&2 bar racks (Table 4-1).

A summary of the range of carapace lengths (mm) and the mean carapace length (mm) for each species of cancer crab impinged at Units 1&2 is provided in Table 4-4.

Table 4-4. Summary of the range of carapace lengths (mm) and mean carapace length (mm) for each species of cancer crabs impinged at MLPP Units 1&2 during the November 9, 2005–November 1, 2006 study.

Species	Number Measured	Carapace Length Range (mm)	Mean Carapace Length
Hairy rock crab *Cancer jordani*	283	7 to 56	18.5
Brown rock crab *Cancer antennaruis*	212	10 to 104	50.2
Red rock crab *Cancer productus*	183	6 to 116	41.8
Slender crab *Cancer gracilis*	24	17 to 83	48.4
Dungeness crab *Cancer magister*	16	9 to 45	28.6
Yellow crab *Cancer anthonyi*	15	12 to 80	39.3

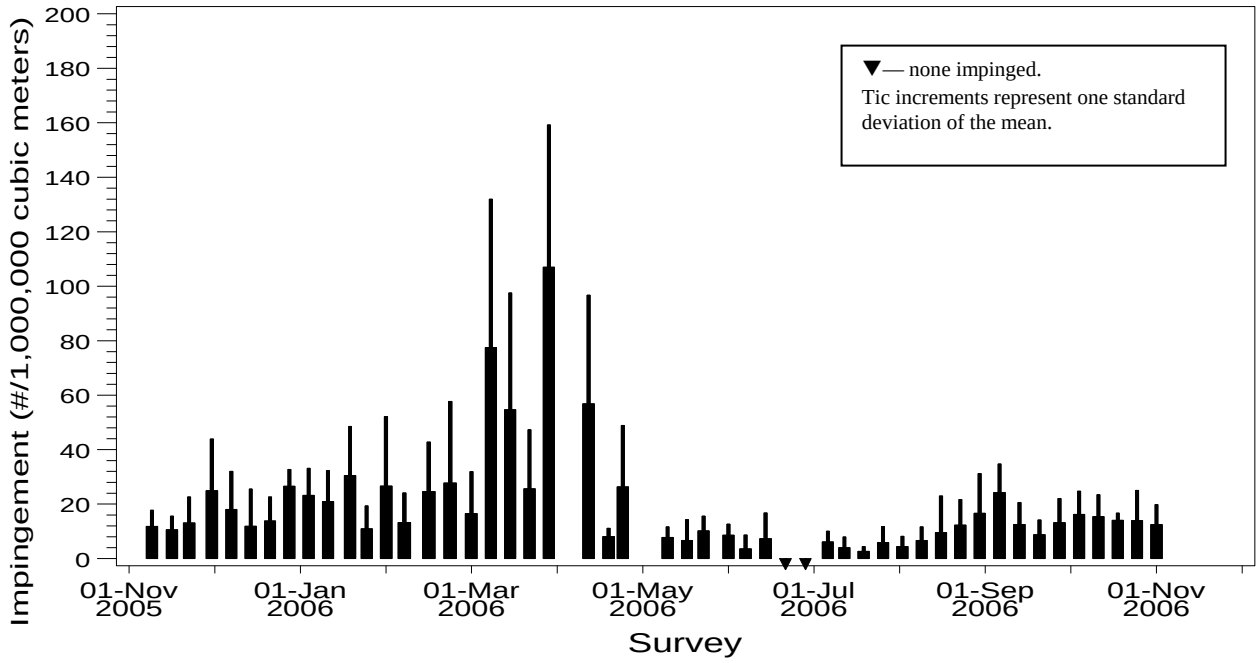
Cancer crabs comprised 3.7 percent of the total number of macroinvertebrates impinged at Units 6&7 (Figure 4-34). A total of 187 rock crabs weighing 10.7 kg (23.5 lb) were collected at Units 6&7 (Table 4-1). Cancer crabs were collected during all 15 surveys (Figure 4-38).

A summary of the range of carapace lengths (mm) and the mean carapace length (mm) for each species of cancer crab impinged at Units 6&7 is provided in Table 4-5.

Table 4-5. Summary of the range of carapace lengths (mm) and mean carapace length (mm) for each species of cancer crabs impinged at MLPP Units 6&7 during the November 9, 2005–November 1, 2006 study.

Species	Number Measured	Carapace Length range (mm)	Carapace Mean Length
Dungeness crab *Cancer magister*	70	23 to 74	40.5
red rock crab *Cancer productus*	53	18 to 138	87.9
brown rock crab *Cancer antennaruis*	23	19 to 141	69.0
hairy rock crab *Cancer jordani*	13	12 to 39	22.5
slender crab *Cancer gracilis*	11	33 to 95	71.4
yellow crab *Cancer anthonyi*	2	109 to 120	39.3

a) Units 1&2 Abundance



b) Units 1&2 Biomass

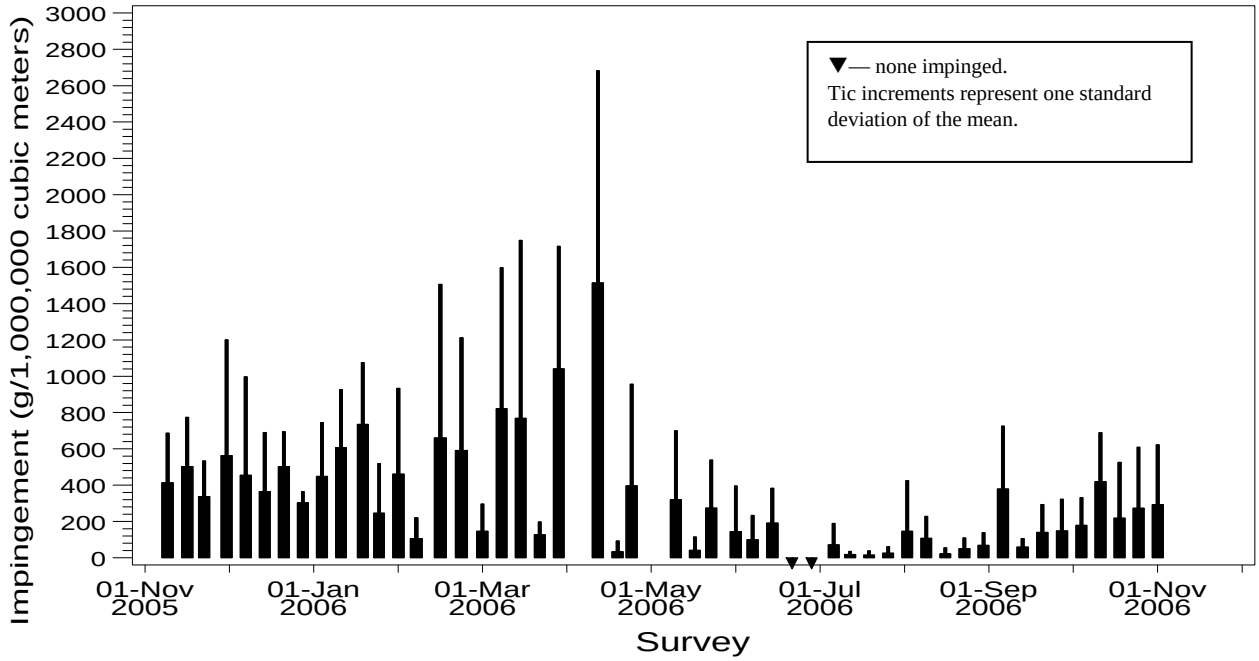
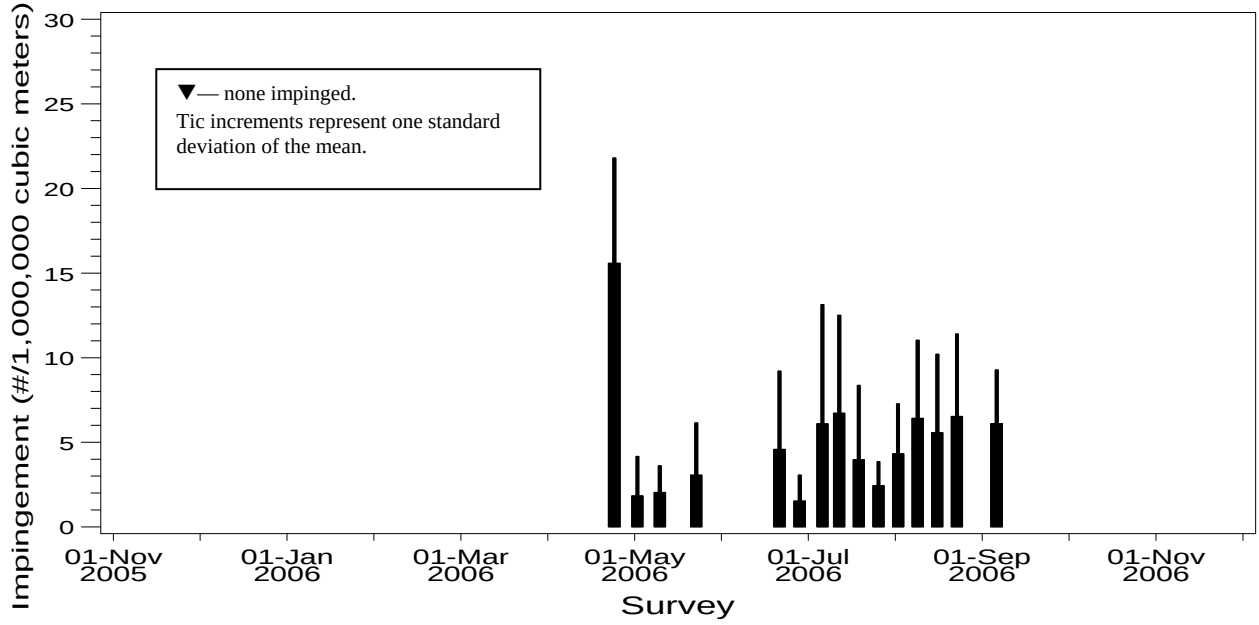


Figure 4-37. Estimated daily impingement of *Cancer* spp. crabs based on the average impingement rate standardized by cooling water intake flow at the MLPP Units 1&2 during the November 9, 2005–November 1, 2006 study.

a) Units 6&7 Abundance



b) Units 6&7 Biomass

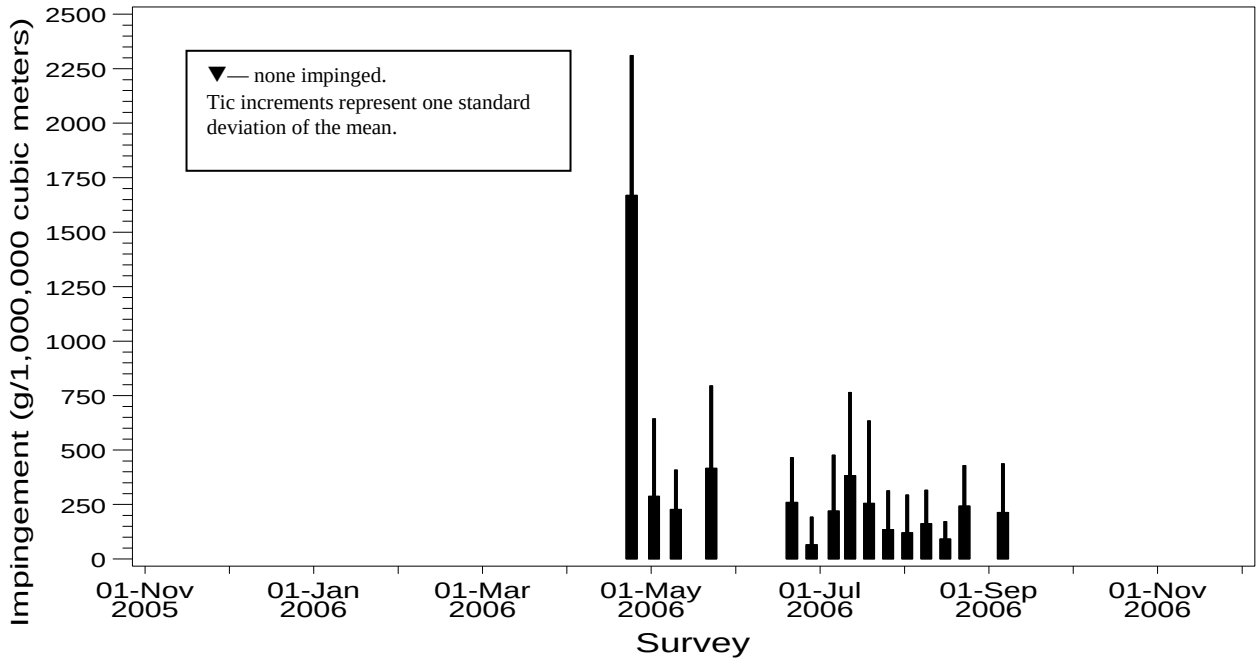


Figure 4-38. Estimated daily impingement of *Cancer* spp. crabs based on the average impingement rate standardized by cooling water intake flow at the MLPP Units 6&7 during the November 9, 2005–November 1, 2006 study.

Moss Landing Power Plant
Impingement Study Data Report

Appendix A

Moss Landing Power Plant
Units 1&2 and Units 6&7
Impingement Study Plan

Duke Energy Moss Landing
Units 1&2 and Units 6&7

Impingement Study Plan

October 2005

Prepared for:

Duke Energy Moss Landing LLC
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1.0 INTRODUCTION

Duke Energy Moss Landing (DEML), LLC has designed an impingement study to comply with EPA's Section 316(b) Phase II Rule of the Federal Clean Water Act. Section 316(b) of the Clean Water Act regulates cooling water intake structures and requires that "… the location, design, construction, and capacity of cooling water intake structures .... are based on the best technology available to minimize the adverse environmental impact associated with the use of cooling water intake structures" (USEPA 2004). The impingement study described in this study plan will support the renewal of DEML's NPDES permit by providing a current characterization of impingement using federal Section 316(b) Phase II rules (USEPA 2004).

Intake-related effects include losses resulting from entrainment (the drawing of organisms into the cooling water system) and impingement (the retention of organisms on intake screening systems) (see Figure 1-1). Entrainment studies were completed in 2000 as part of the Duke Energy Moss Landing Power Plant Modernization Project, which involved the construction and operation of two new combined-cycle generating units (Units 1&2). The entrainment study results and analysis were submitted to the Regional Water Quality Control Board and the California Energy Commission (CEC) in a report titled *Moss Landing Power Plant Modernization Project 316(b) Resource Assessment* (Tenera 2000). The CEC and RWQCB did not require an evaluation of impingement as part of the resource assessment at that time.

The use of seawater in power plant cooling water systems (CWS) requires that objects in the water larger than the diameter of the condenser tubes be screened to avoid plugging the condensers. Most CWS intakes employ 3/8 in. (0.953 cm) mesh traveling screens that rotate out of the water to clear debris and organisms from the mesh. Cooling water that flows through the traveling screens can impinge weakly mobile organisms against the screens or entangle them in screened debris. These organisms are typically juvenile and adult fishes and macroinvertebrates. The location of the intake and traveling screens, the approach velocities, and the quantity of debris in the water are all factors that can affect impingement rates. Impingement studies were previously conducted at DEML in 1979–1980, and the results were presented in the Moss Landing Power Plant Cooling Water Intake Structures 316(b) Demonstration (PG&E 1983).

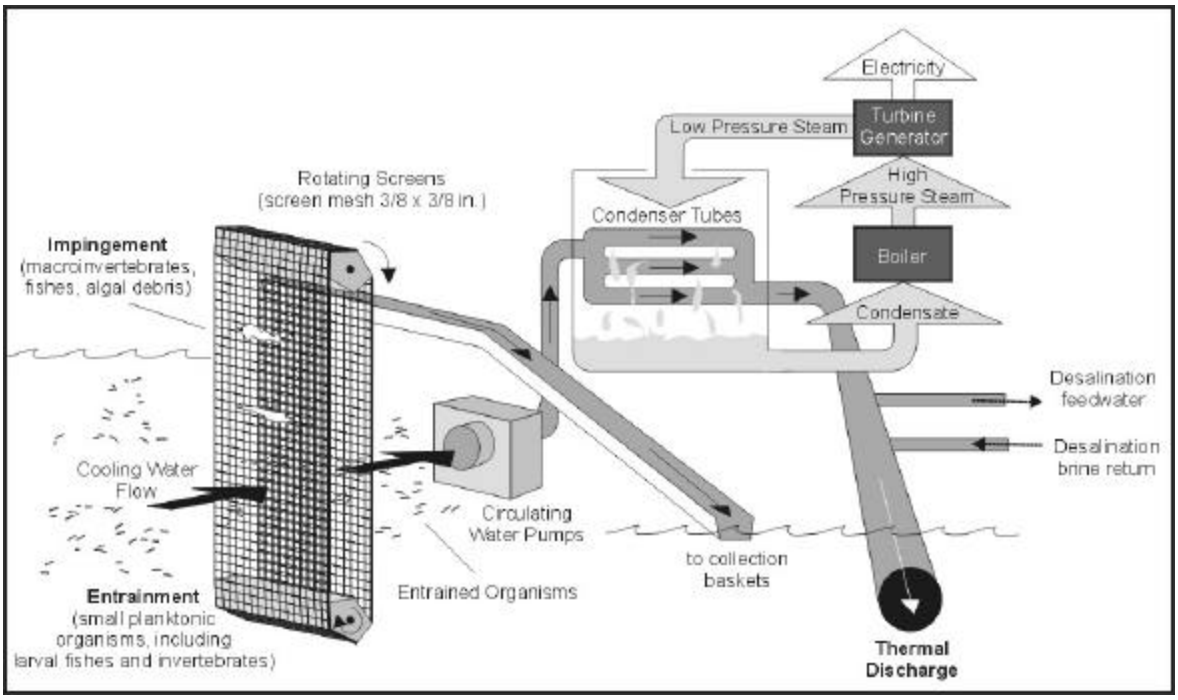

Figure 1-1. Conceptual diagram of impingement and entrainment processes and their relationship to a once-through cooling water system with a desalination feedwater supply and return.

Most species of fish have the swimming capability to avoid impingement. Divers, swimming in front of the intake at the Diablo Canyon Power Plant, have documented young-of-the-year rockfish *Sebastes* spp., blackeye goby *Coryphopterus nicholsi*, and other small fishes swimming against the current just in front of the bar racks (Tenera, Inc. 1998). Other observations, recorded on video tape, showed a 15 cm (5.91 in.) painted greenling *Oxylebius pictus* swimming off of the traveling screen after apparently resting there (Tenera 1998). However, it has been demonstrated that when there are large amounts of detritus (plant material) in the intake area, organisms strong enough to avoid the intake may become trapped in the detritus and become susceptible to impingement (PG&E 1982).

The common size screen mesh of 3/8 in. (0.953 cm) is designed both to prevent condenser tubes from plugging and to minimize the approach and through-screen velocities for fish protection. As the mesh size is increased more larval and juvenile fish will enter the power plant's cooling water system (be entrained) and be subjected to mechanical, chemical, and thermal stresses. A reduction in mesh size of traveling screens will increase the rate of impingement and the stress of through-screen velocities.

Several new designs were incorporated into the Units 1&2 intake structure as part of the modernization project that are expected to reduce the quantity of debris and the number of

organisms impinged on the intake screens. It is important to note that the data from the prior impingement study showed the overall rate of impingement (standardized for differences in cooling water flow) was higher at the old Units 1-5 intake than at Units 6&7 intake. This was true for both fishes and macroinvertebrates (by a factor of 1.6 for fishes and 3.3 for macroinvertebrates) (PG&E 1983).

The cooling water volume pumped through the Units 1&2 intake structure was reduced from 381,000 gpm (1,441 m^3/min) for Units 1-5 to 250,000 gpm (946 m^3/min) for the new combined-cycle units. As a result of the lower flows, approach velocities measured at the intake structure bar racks decreased from 0.9 feet per second (fps) to 0.3 fps. The new traveling screens are inclined at an approximate angle of 35° from vertical thus providing more surface screen area resulting in lower through-screen velocities. During screen rotation of the vertical traveling screens, debris had a tendency to fall back into the water at the air/water interface and accumulated into a large mass. The accumulated debris would clog a portion of the submerged screen and increased the water velocity through the unclogged portion. The new angled screens are more effective at removing debris than the conventional vertical traveling screens, thereby maintaining more of the submerged screen in a clean, unclogged condition. The old Units 1-5 also had a long intake tunnel (approximately 350 ft) separating the bar racks from the traveling screens. The new combined cycle (CC) intake structure design has the traveling screens approximately 20 feet (6.1 m) behind the bar racks. This shortening of the tunnel helps to reduce impingement of schooling fishes that can become disoriented in the longer tunnel and subsequently impinged.

2.0 DESCRIPTION OF THE DUKE ENERGY MOSS LANDING AND CHARACTERISTICS OF THE SOURCE WATER BODY

This section describes Duke Energy Moss Landing and its aquatic environmental setting. Section 2.1 describes Units 1&2 and Units 6&7 and their cooling water systems. The aquatic environment in the vicinity of the plant is described in Section 2.2.

2.1 Duke Energy Moss Landing

Duke Energy Moss Landing, LLC (DEML) is located on the eastern shoreline of Moss Landing Harbor (Figure 2-1). This medium sized harbor, which provides dock space for approximately 600 commercial and recreational vessels, is located about 110 miles (177 km) south of San Francisco. Moss Landing Harbor is located roughly midway between Santa Cruz and Monterey, California and is open to Monterey Bay. The plant is located in a relatively undeveloped area that includes industrial facilities, agricultural lands, sparse residences, recreational beaches, and tidal wetlands.

DEML has two separate intake structures in Moss Landing Harbor for withdrawal of cooling water that is necessary to remove excess heat from the power generation process (Figure 2-2). Units 1&2 are two 530-MW high efficiency combined-cycle (CC) generating units. Units 6&7 are two 765-MW natural gas fueled boiler units (Table 2-1). Each combined-cycle unit consists of two advanced class combustion turbine generators, two heat recovery steam generators, and a single steam turbine generator. The combined-cycle units are capable of generating about 1,060 MW while using about 250,000 gpm (946 m^3/min) of once-through ocean cooling water (at 20°F [11.1°C] temperature increase). The cooling water and screen wash water withdrawal for Units 1&2 and Units 6&7 is shown in Table 2-2. Two separate subsurface conduits carry the discharge from Units 6&7 to a submerged offshore discharge structure located in Monterey Bay about 2,400 feet from the plant, and approximately 600 feet offshore. The discharge from Units 1&2 is normally divided between the Unit 6 and Unit 7 discharge conduits, but can be directed in its entirety into either conduit.

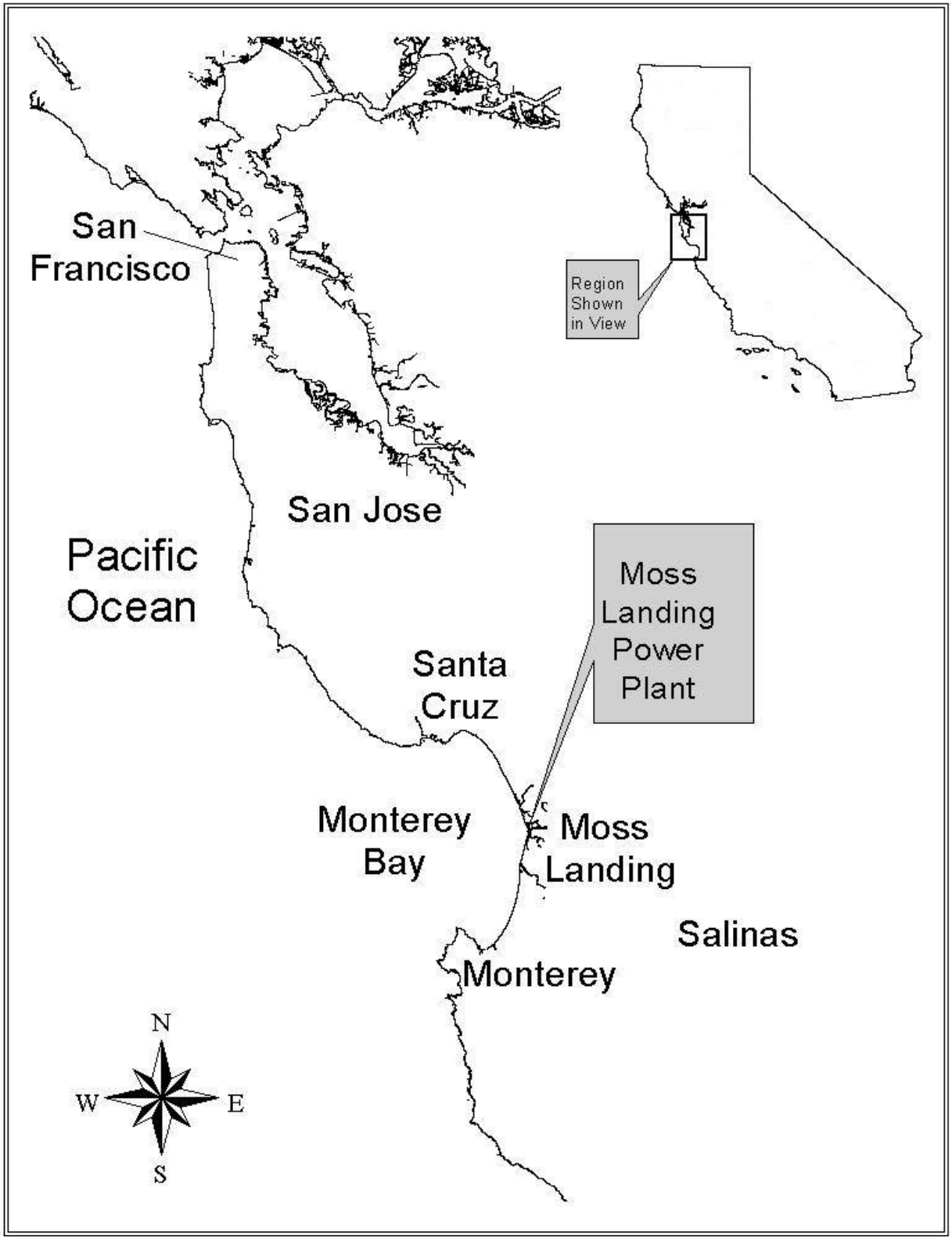

Figure 2-1. The location of Duke Energy Moss Landing.

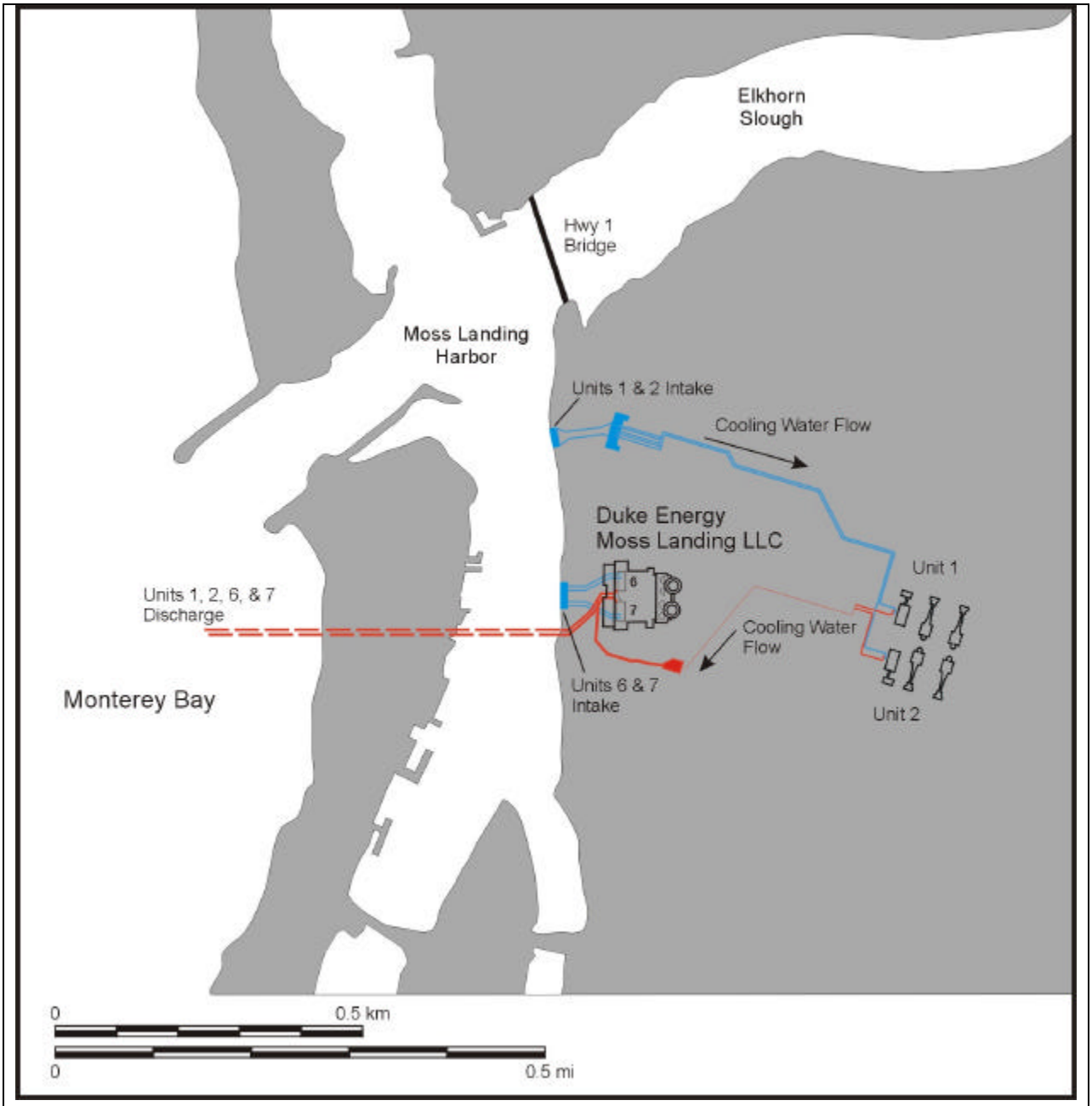

Figure 2-2. Map of Duke Energy Moss Landing showing locations of both intake structures, cooling water conduits, and discharge structure.

Table 2-1. Duke Energy Moss Landing Units 1&2 and Units 6&7 generating capacity.

Unit	Megawatts
Unit 1	530
Unit 2	530
Total Units 1&2	1,060
Unit 6	765
Unit 7	765
Total Units 6&7	1,530
Plant total	**2,590**

Table 2-2. Duke Energy Moss Landing Units 1&2 and Units 6&7 daily maximum design water flow.

Water Use	Daily Flow mgd	Daily Flow m^3/day
Unit 1 cooling water (3 pumps total)	180	681,300
Unit 2 cooling water (3 pumps total)	180	681,300
Units 1&2 screen wash water (3 pumps total)	0.65	2,460
Total Units 1&2	361	1,365,060
Unit 6 cooling water (2 pumps total)	432	1,635,120
Unit 7 cooling water (2 pumps total)	432	1,635,120
Units 6&7 screen wash water (3 pumps total)	0.65	2,460
Total Units 6&7	865	3,272,700
Plant total	**1,225**	**4,637,760**

Source: NPDES Permit No. CA 0006254.

2.1.1 Units 1&2

DEML Units 1&2 are two 530 MW combined cycle generating units that began commercial operation in the Spring 2002. Each unit is cooled by three circulating water pumps (CWP), with a combined flow of 125,000 gpm. Cooling water is drawn from Moss Landing Harbor, entering the system through an intake structure located on the east side of the Harbor, about 500 feet south of the entrance to Elkhorn Slough (Figure 2-2). The concrete intake structure was originally built to serve the plant's former Units 1-5 that were constructed in the 1950s. Units 1-5 permanently ceased operation in 1995, and the intake was later modified to meet the debris filtration needs of the new Units 1&2. Water entering the system initially passes through a bank of vertical bar racks (Figure 2-3). The bars are positioned with approximately 4 inch center-to-center spacing which provides 3½ inch wide openings between bars.

Figure 2-3. Units 1&2 intake bar racks.

The bar racks extend from the deck of the intake structure, 9.4 feet above mean lower low water (MLLW), down to the Harbor bottom at a depth of 20.1 feet below MLLW. Debris impinged on the bars is removed by an automated raking system (Figure 2-4) and deposited in a receptacle for subsequent disposal in a landfill.

During a December 2004 survey, water velocity immediately in front of the Units 1&2 bar racks ranged from 0.25 to 0.30 feet per second (fps) among the six intake bays, and averaged 0.27 fps over the entire intake (Tenera 2005).

Figure 2-4. Units 1&2 intake bar rack rake.

Located approximately 20 feet behind the bar racks are the traveling water screens (TWS). The TWS remove most of the debris that is small enough to pass through the bar racks, but large enough to potentially clog the plant's condenser tubes. Each generating unit has a bank of three screens. Each of the screens is 10 feet wide and extends down to the floor of the intake structure, 20 feet below MLLW. When the TWS are in operation, cooling water passes through an upward rotating belt of stainless steel screen with an effective mesh size of 5/16 inch (Figure 2-5). The screen belt lifts debris out of the flow stream and carries it to the top of the TWS where a seawater screenwash system sprays the debris off the screen and onto a conveyor belt. The conveyor belt carries the debris to the same receptacle utilized by the bar rack rake system (Figure 2-6). The Units 1&2 TWS are inclined 35 degrees from vertical to enhance their ability to retain debris. This also reduces the through-screen velocity by presenting a larger screen area to the flow than would be presented by a vertical TWS. The traveling screens are normally operated (rotated) every 4 hours for a period of 20 to 30 minutes. They can also be activated automatically during periods of high debris loading if the differential water height between the upstream and downstream sides of the TWS exceeds a predetermined value due to clogging of the stationary screen. The screens can also be run continuously, as a

precaution, when debris levels are high. Water velocity in front of the TWS has not been measured directly, but has been calculated to be about 0.5 fps.

Figure 2-5. Units 1&2 traveling water screens. Four of the six screens are shown.

Figure 2-6. Traveling water screen debris conveyor system. Bar rack rake is in the background.

The circulating water pumps (CWP) that supply cooling water to Units 1&2 are located approximately 300 feet downstream of the TWS (Figure 2-7). Each generating unit has three CWP that provide a total cooling water flow of 125,000 gpm (180 mgd) to its steam condenser and other heat exchangers.

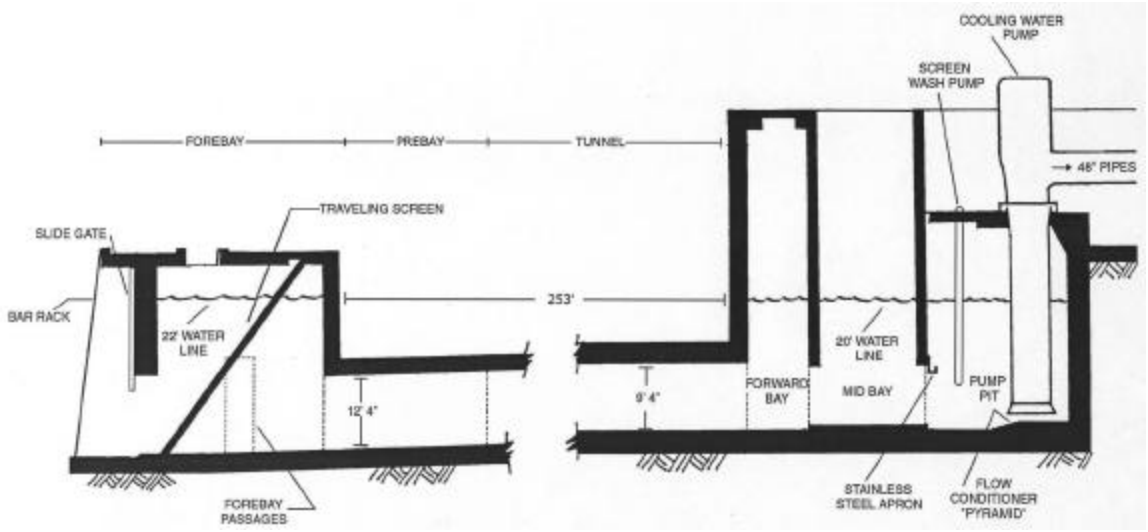

Figure 2-7. Cross-sectional diagram of the Units 1&2 intake structure and pumpbays.

Each of the three CWP discharge into individual 48-inch pipes which, after a run of about 200 feet, join together into a single 84-inch diameter pipe. The two 84-inch lines (one per unit) carry the cooling water a distance of about 2,000 feet to the Unit 1&2 condensers. Upon exiting the condensers, the two discharge lines feed into a single 120-inch discharge pipe that runs about 1,400 feet to the disengaging basin. The disengaging basin is a concrete reservoir, open to the atmosphere, where turbulent mixing aerates the discharge flow and provides some cooling. The basin also acts as a vacuum beaker and prevents siphoning of the discharge flow. The discharge exits the disengaging basin via two discharge conduits that run about 600 feet to a point just west of the Units 6&7 turbine building where they join the Unit 6 and Unit 7 discharge lines. Stop logs can be inserted at the disengaging basin to direct the Units 1&2 discharge into either the Unit 6 or Unit 7 flow streams or, as is normally the case, they can be removed to allow the flow to be split between the two conduits. The two discharge conduits carry the combined discharge of all four generating units about 2,400 feet from the plant to the discharge structure located approximately 600 feet offshore in Monterey Bay.

2.1.2 Units 6&7

Units 6&7 intake structure is located on the east shore of Moss Landing Harbor about 700 feet south of the Unit 1&2 intake structure (Figure 2-2). The structure has many of the same features found at the Unit 1&2 intake, bar racks and traveling water screens, but the layout is considerably different (Figure 2-8). The bar racks are located behind a vertical curtain wall that extends down to about 3 feet below MLLW. The wall prevents large floating debris from being impinged on the bar racks. The spacing between bars is about 3 inches. Approach velocity in front of the bar racks was measured in December 2004, the average velocity across the entire intake was 0.6 fps.

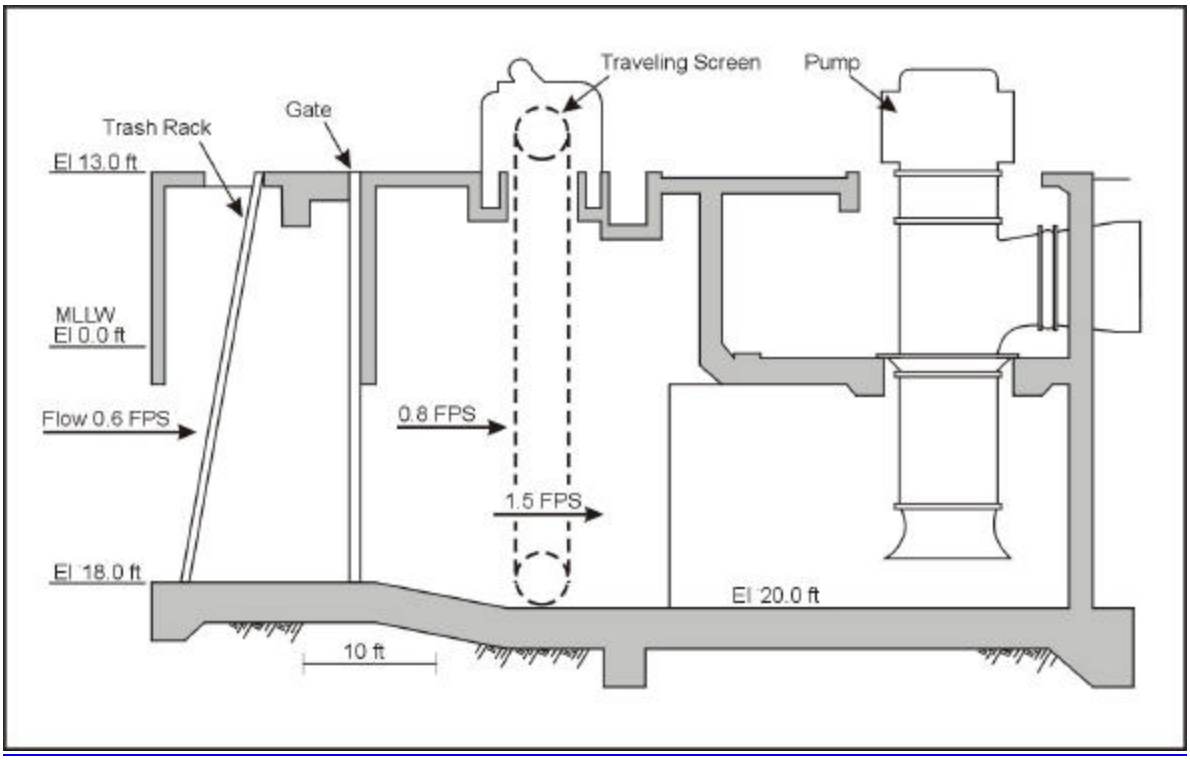

Figure 2-8. Cross-sectional diagram of the Units 6&7 intake structure.

Traveling water screens are located about 25 feet downstream of the bar racks. These are vertical traveling screens with 3/8-inch screen mesh. Each generating unit has four 10 foot wide TWS, two serving each of its CWP, that extend down to the floor of the intake structure (20 feet below MLLW). The screenwash system removes debris from the screens, and flushes it into a sluiceway that empties into a screenwash wet well. The screenwash discharge, less the impinged material, is returned to Monterey Bay by large-diameter screen refuse pumps that empty into the discharge conduits of Units 6&7. The impinged material that is retained in the wet well is periodically removed by a local refuse collection contractor and trucked to a sanitary landfill for disposal. Due to the limited operation of Units 6&7, the traveling screens are currently rotated and cleaned on an as-needed basis. They can also be activated automatically during periods of high debris loading if the differential water height between the upstream and downstream sides of the TWS exceeds a predetermined value due to clogging of the stationary screen. The screens can also be run continuously, as a precaution, when debris levels are high. Water velocity at the TWS has not been measured in recent years but was calculated in the past to be 0.8 fps approaching the TWS and 1.5 fps through the screens.

Both generating units have two CWP that each provide a nominal flow of 150,000 gpm (300,000 gpm (432 mgd) per unit). Unlike the Units 1&2 CWP, the Units 6&7 pumps are located immediately behind the TWS (about 30 feet) and about 400 to 450 feet upstream of the

plant's condensers. Each CWP discharges into its own conduit. Each conduit supplies cooling water to half of a generating unit's condenser. Upon exiting the condenser, the cooling water from both condenser halves flows into a common discharge conduit. The discharge from Unit 6 remains separate from that of Unit 7. The discharge flow from Units 1&2 joins the Units 6&7 discharge about 100 feet downstream of the condensers. The flow from Units 1&2 can be directed in its entirety into either the Unit 6 or Unit 7 conduit, but is normally split between the two. The two separate subsurface discharge conduits carry the flow from each unit to a submerged offshore discharge structure located in Monterey Bay 2,400 feet from the plant, and approximately 600 feet offshore.

2.2 Aquatic Environment in the Vicinity of DEML

Duke Energy Moss Landing is situated at the intersection of three distinct marine geographic areas: Elkhorn Slough (tidal lagoon), Moss Landing Harbor, and Monterey Bay. Each of these areas has its own unique aquatic biological habitats. Distinct aquatic habitats present within the boundaries of Moss Landing Harbor and Elkhorn Slough include shallow open water, submerged aquatic vegetation, sand/mud/salt flats, fresh/salt/brackish marshes, rocky subtidal and intertidal. Distinct habitats present in Monterey Bay include sandy beach, rocky intertidal and subtidal, and open water areas.

A large body of information exists which describes the physical characteristics and biological habitats of Elkhorn Slough, Moss Landing Harbor, and Monterey Bay. Information on the aquatic environment in the vicinity of DEML is summarized from studies conducted for the power plant and from studies in Elkhorn Slough and Moss Landing Harbor conducted by outside investigators. Thermal effects studies were conducted in the late 1970s by Pacific Gas and Electric Company (PG&E) (the plant's former owner), entrainment and impingement 316(b) studies were conducted in 1978–1980 (PG&E 1983), and entrainment and thermal effects studies were conducted again by Duke in 1999–2000 (Tenera 2000). Several investigators from nearby Moss Landing Marine Laboratories have provided information on the habitats and physical characteristics of Elkhorn Slough and Moss Landing Harbor. Nybakken et al. (1977) conducted ecological and hydrographical studies of Elkhorn Slough, Moss Landing Harbor, and near-shore coastal waters from July 1974 to June 1976. Malzone and Kvitek (1994) and Malzone (1999) studied tidal scour, erosion, sediment transport, and habitat loss in Elkhorn Slough. Oxman (1995) studied the food habits of harbor seals *Phoca vitulina richardsi* in Elkhorn Slough. The effects of erosion on the trophic ecology of fishes in Elkhorn Slough were studied by Lindquist (1998). Yoklavich et al. (1991, 1992, draft 1999) studied fish assemblages in Elkhorn Slough and Moss Landing Harbor. California Department of Fish and Game (CDFG) landings data

provide information on fishes harvested in Monterey Bay. Results of these and other studies, and commercial and recreational fishing records are summarized in the following sections.

2.2.1 Elkhorn Slough/Moss Landing Harbor

Elkhorn Slough is a narrow, shallow water embayment that extends 6.2 miles inland from the eastern margin of Monterey Bay. As it extends inland, it gradually narrows and decreases in depth. Tidal mud flats and pickleweed (*Salicornia* spp.) marsh extend the length of the slough. The drainage basin for Elkhorn Slough is only 226 square miles in area. The land near the slough is used primarily for agriculture. Shallow open water and lagoon habitats comprise the majority of aquatic habitat provided by the Elkhorn Slough and Moss Landing Harbor complex.

Several changes have occurred in the hydrology and channel geomorphology since the time of the PG&E entrainment and impingement studies in 1978–1980 (Malzone and Kvitek 1994, Oxman 1995, Lindquist 1998). In the mid 1980s several dikes and levees surrounding pasture lands were reopened to tidal flow. These changes increased the surface wetlands by 48 percent and the tidal volume by 43 percent (Malzone and Kvitek 1994). The increased volume of water exchanged with the tides has increased both the rate of erosion and the velocity of the tidal currents (Philip Williams and Associates 1992, cited in Lindquist 1998, Malzone and Kvitek 1994). Recent studies of the effects of this erosion on the trophic ecology of the slough (Lindquist 1998) and studies of the prey availability for harbor seals (Oxman 1995) provide updated information on the species composition of adult fishes in the slough. Yoklavich et al. (draft 1999) discuss data collected from numerous studies (past and present) on fish assemblages found in Elkhorn Slough habitats and surrounding marine waters.

The varied marine and estuarine habitats within Elkhorn Slough provide habitat for at least 97 species of fish representing 40 families (Yoklavich et al. 1992, draft 1999). Most (76) of these species are marine species from Monterey Bay. Fish species utilizing the slough were divided by Yoklavich et al. (draft 1999) into several groups. Immigrant marine species typically use the slough for spawning or as a nursery ground. These species include the northern anchovy *Engraulis mordax*, Pacific herring *Clupea pallasi*, and cabezon *Scorpaenichthys marmoratus*. Numerous species of flatfish including the speckled sanddab *Citharichthys stigmaeus*, English sole *Parophrys vetulus*, sand sole *Psettichthys melanostictus*, starry flounder *Platichthys stellatus*, California halibut *Paralichthys californicus*, and several species of turbot are also considered immigrant marine species. Fish species considered permanent residents include the Pacific staghorn sculpin *Leptocottus armatus*, black surfperch *Embiotoca jacksoni*, striped mullet *Mugil cephalus*, bay pipefish *Syngnathus leptorhynchus*, and five species of gobies. Partial residents, or species that live or reproduce in the slough but migrate to the ocean during certain seasons or life stages, include the jacksmelt *Atherinopsis californiensis*, shiner surfperch

Cymatogaster aggregata and white surfperch *Phanerodon furcatus*, leopard shark *Triakis semifasciata*, and bat ray *Myliobatis californica*. Species primarily associated with freshwater include American shad *Alosa sapidissima* and threadfin shad *Dorosoma petenense*, mosquitofish *Gambusia affinis*, prickly sculpin *Cottus asper*, threespine stickleback *Gasterosteus aculeatus*, and striped bass *Morone saxatilis*. Few non-native species have been noted (yellowfin goby *Acanthogobius flavimanus*, mosquitofish, American shad, and striped bass).

In 1991, otter trawls were conducted as part of a study of fish availability as prey items for harbor seals (Oxman 1995). Otter trawls were conducted monthly for a year (1991) in Elkhorn Slough in an effort to establish seasonal trends of fish availability and distribution. The trawls were taken at the same three stations (Bridge, Dairies, and Kirby Park) sampled by Nybakken et al. (1977) and reported by Yoklavich et al. (1992) in the main channel of the slough. Eighty-three daytime otter trawls captured 1,955 fishes representing 41 species. The 29 nighttime trawls at two stations (Dairies and Bridge) resulted in 1,461 fishes representing 39 species.

More than 90 percent of the fishes taken in the daytime and nighttime trawls were represented by 11 species. These fishes included shiner surfperch, English sole, staghorn sculpin, California tonguefish *Symphurus articauda*, speckled sanddab, white surfperch, cabezon, black surfperch, and lingcod *Ophidion elongatus*. Pipefish *Syngnathus* spp. was caught during the daytime trawls and brown rockfish *Sebastes auriculatus* was caught at night.

Oxman (1995) reported that overall there was a slight change in the 1991 diurnal fish assemblage from that reported by Yoklavich et al. (1992) during 1974–1976. These changes included a decrease in the mean number of fish per tow, species diversity decrease at the Bridge and Dairies stations, and species diversity increases at Kirby Park. Species absent from the 1991 daytime trawls that were present in 1974–1980 trawls included topsmelt *Atherinops affinis*, jacksmelt, Pacific herring, threadfin shad, sand sole, blue rockfish *Sebastes mystinus*, queenfish *Seriphus politus*, and night smelt *Spirinchus starksi*. Several species were less abundant. English sole, cabezon, lingcod, and California tonguefish increased in relative abundance and density.

Oxman (1995) stated that there was a significant change in fish assemblages at the Bridge and Dairies stations since the 1974–1980 otter trawls. Several species were absent and many were caught in less abundance in the 1991 tows. English sole, lingcod, and California tonguefish increased in relative abundance and density.

Lindquist (1998) collected fishes in otter trawls to provide information on their feeding habits from four stations in Elkhorn Slough from May 1996–May 1997. He analyzed 11 species of fish from nine families. The species were yellowfin goby, topsmelt, speckled sanddab, arrow goby *Clevelandia ios*, Pacific herring, shiner perch, northern anchovy, Pacific staghorn sculpin, white

surfperch, English sole, and California tonguefish. These species accounted for 96 percent of the total abundance from the otter trawls. Of those species all but yellowfin goby and California tonguefish were dominant fishes during studies conducted in Elkhorn Slough in the 1970s (Lindquist 1998).

Yoklavich et al. (draft 1999) discussed several distinct habitat types which have been sampled within the slough. Different sampling methods were used for each habitat type (otter trawl, beach seine, and channel nets). The most abundant and diverse family of fishes within the slough and surrounding coastal waters are the embiotocids. Shiner perch was the most common species found throughout the habitats studied and the Pacific staghorn sculpin was the most abundant species in upper slough areas. Several large elasmobranchs were also relatively common within the slough (bat ray, shovelnose guitarfish *Rhinobatos productus*, gray smoothhound *Mustelus californicus*, and leopard shark) (Yoklavich et al. draft 1999, San Filippo 1994).

Yoklavich (draft 1999) concluded that in general, fish assemblages present in Elkhorn Slough in the 1990s are characterized by decreased abundance at most sample sites as well as less diversity than in the past. Within the last twenty years a homogenization of fish assemblages appears to have occurred between the lower main channel and tidal channels. These changes have coincided with the continued erosion and scouring of smaller channels to the point that they are now similar (in habitat type) to the main channel (Malzone and Kvitek 1994).

The most abundantly collected fishes from studies reported in Nybakken et al. (1977), Yoklavich et al. (1991), from PG&E impingement studies in 1978–80 (PG&E, 1983), and from Lindquist's work in 1996–1997 generally have remained the same. Northern anchovy, shiner perch, and Pacific herring were some of the most abundantly collected fishes from all three of these studies. Topsmelt was the only species collected in high numbers in the impingement samples that was not collected in the other two studies. Oxman's (1995) studies in 1991, however, showed greater differences in species composition when compared to the other studies, with the exception of the presence of shiner perch. This species was collected in high numbers in the slough from all studies. Fishes that were not collected in Oxman's study but were present in high numbers in all other studies were northern anchovy and Pacific herring. Both of these missing species were again collected in high numbers in Lindquist's 1996–1997 studies.

2.2.2 Monterey Bay

Monterey Bay, California's largest open-coast embayment, is formed by the extent of shoreline between Santa Cruz and Monterey and by the offshore depths of the Monterey submarine canyon. The opening of the bay is 23 miles across and 10 miles wide. Four main tributaries, the Pajaro

River, Elkhorn Slough, the Salinas River, and the San Lorenzo River flow into the Bay. The Bay's immense supply of cold, nutrient-rich, ocean water is exchanged tidally with the Elkhorn Slough and harbor located midway along the bay shoreline at the head of the canyon.

Monterey Bay lies within the boundaries of the Monterey Bay National Marine Sanctuary (MBNMS). The MBNMS extends from 7 miles north of the Golden Gate Bridge to Cambria Rock in northern San Luis Obispo County. The sanctuary contains about 400 statute miles of coastline and extends an average of 30 miles offshore. Its total area is 5,322 square miles. The MBNMS was officially established in 1992 by the authority of the Secretary of Commerce under the 1972 Marine Protection, Research and Sanctuaries Act. The MBNMS is one of fourteen marine sanctuaries in the United States under the jurisdiction of the National Oceanic Atmospheric Association (NOAA) of the U.S. Department of Commerce.

Monterey Bay is characterized by a gently sloping shelf cut by a system of submarine canyons, the largest of which is the Monterey Submarine Canyon. The head of this canyon is located off of the entrance to Moss Landing Harbor. The depth of the canyon ranges from 60–2,800 feet. The canyon is 650 feet wide at the head and approximately 7.5 miles wide at the mouth of Monterey Bay.

Monterey Bay's sandy beach habitat extends in nearly a continuous reach of approximately 20 miles from Santa Cruz to Monterey, encompassing the Moss Landing area. Beach habitat in the area of Moss Landing is exposed to high-energy waves from the northwest. Large quantities of sand are annually transported on and off the beach shoreline by strong waves and longshore currents. The continuously changing nature of this habitat favors mobile invertebrate and fish species that adjust quickly to the depletion and accretion of sediments. Relatively few species are able to adjust to this habitat.

The marine resources of Monterey Bay support a variety of commercial fisheries (Starr et al. 1998). Many of the fisheries are very dynamic. Landings are driven by the demands of the market, the abundance of the target species, and attempts by the regulators to reduce harvest. As new markets are found for species that were previously unmarketable or of low value, annual landings of those species can increase rapidly. Landings from other fisheries decline as fishermen fill the demands of the new markets. Regulation of fish harvest, entry into a fishery, gear usage, and season length can have a pronounced effect on landings. Fisheries also decline and expand with the cycles of abundance and scarcity of the targeted species. Long-term over-exploitation of many fish stocks along the Pacific Coast has decreased the abundance of adult fishes and recently led to more restrictive regulation of harvest levels. Some regulations were made because of concerns regarding declines in populations. Declines in landings often follow regulatory efforts and may not directly reflect species abundance. Because of the complexity of

the forces driving fish harvest in the Monterey Bay area, generalizations about fish abundance based on landing data must be made carefully.

CDFG catchblock data from 1975–1998 were discussed in the Moss Landing Power Plant Modernization Project 316(b) Resource Assessment (Tenera 2000) and provide information on Monterey Bay's aquatic resources. These catchblock data will be updated and discussed in the Impingement Characterization Report.

The Pacific Fishery Management Council develops and recommends harvest specifications and management measures to National Marine Fisheries Service (NMFS). Many new regulations regarding both commercial and sport fishing for species in Monterey Bay such as rockfishes and prawns were implemented in the past several years and will be discussed in the Impingement Characterization Report.

Fishes and invertebrates are harvested from the Monterey area using a variety of fishing methods. Most of the fishes landed in Monterey ports between 1975–1998 were taken with purse seine and trawl nets. Set gillnets have traditionally been used to harvest California halibut, rockfish *Sebastes* spp., white croaker *Genyonemus lineatus,* and a variety of sharks. Commercial fishermen use trolling gear to harvest salmon and albacore during the seasons when they are abundant in the area. Hook-and-line gear has traditionally been used to harvest rockfish and lingcod over rocky reefs near the canyon. Set longlines, which are now prohibited in nearshore waters (within 1 mile), are used in the Monterey canyon area to take sablefish *Anoplopoma fimbria* and grenadier (Family Macrouridae). Fish traps and "stick gear" are used in the live rockfish fishery. Traps are also used to take rock crabs *Cancer* spp. and Dungeness crab *Cancer magister*.

The most effective gear for certain species, in terms of biomass harvested, is the purse seine. Purse seining is used to harvest pelagic species such as market squid *Loligo opalescens,* Pacific sardine *Sardinops sagax,* northern anchovy, and both Pacific mackerel *Scomber japonicus* and jack mackerel *Trachurus symmetricus*. Market squid has consistently been one of the top two species landed in the Monterey area. Northern anchovy, Pacific sardine, Pacific mackerel, and jack mackerel are harvested from Monterey Bay. Pacific herring have also been harvested from the area.

Commercial trawlers in the area target a variety of demersal fish species, or groundfish. There are several distinctly different trawl fisheries in Monterey Bay. The species targeted depends largely on what permits the boats, or owners/captains have been able to acquire. The harvest of groundfish species is closely regulated by the Pacific Fisheries Management Council and National Marine Fisheries Service. The DTS complex (Dover sole *Microstomus pacificus,*

thornyhead *Sebastolobus* spp., and sablefish) is targeted only by vessels with federal limited-entry groundfish permits. The harvest of the DTS complex is second to that of purse seiners in terms of biomass.

Trawlers with federal groundfish permits also target splitnose *Sebastes diploproa* and aurora rockfish *Sebastes aurora* (Rosefish market category), widow rockfish *Sebastes entomelas*, bocaccio rockfish *Sebastes paucispinis*, chilipepper rockfish S*ebastes goodei*, and Sebastes complex species. The Sebastes complex is composed of a mixture of rockfish species that do not have specific quotas. Sebastes complex species are often landed in the market category "unspecified rockfish."

Trawlers without a federal groundfish permit also harvest groundfish (except DTS), however, these "Open Access" fishermen are subject to more restrictive quotas. Because of restrictive rockfish quotas, the open access trawl fishery generally targets demersal fish species such as California halibut, white croaker, sole, and Pacific sanddab *Citharichthys sordidus*. Starry flounder, turbot *Pleuronichthys* spp., and Pacific angel shark *Squatina californica* are among the non-target species caught in this fishery that are considered saleable by-catch. White croaker are also harvested by open access trawlers. Pink shrimp *Pandalus eous* have become the target of a large number of open access trawlers with shrimp or prawn permits. On February 18, 2003, the Fish and Game Commission adopted regulations prohibiting the use of trawl nets to take spot prawn *Pandalus platyceros*.

Gillnets have been an effective gear used in the past to harvest a variety of species. California halibut are the target of the fishery, however, white seabass *Cynoscion nobilis*, white croaker, and several shark species are also regularly landed by gillnetters. Concern over sea otter mortality resulted in regulation of the depth in which gillnets could be set. Currently, gillnets cannot be set inside of 30 fathoms (55 m or 180 ft) of water. Recent regulation of open access rockfish harvest has eliminated much of the gillnet effort for rockfish.

The commercial troll fleet in the Monterey Bay area targets Chinook salmon *Oncorhynchus tshawytscha* and albacore *Thunnus alalunga* when they are in season and available. The salmon fishery has traditionally been one of the more lucrative fisheries in the bay for small, independent commercial fishermen. Albacore are caught by trollers in the outer regions of Monterey Bay during years when warmer water is relatively close to land.

During the early 1990s a new fishery evolved to supply the market demand for live fish. The fishery targets nearshore rockfish species (grass rockfish *Sebastes rastrelliger*, gopher rockfish *Sebastes carnatus*, brown rockfish, china rockfish *Sebastes nebulosus*, etc.) and cabezon. Fishes are taken from the intertidal zone down to depths of 30 m (100 ft) with hook and line gear or

traps and kept alive in holding tanks. Kelp greenling *Hexagrammos decagrammus* and lingcod are not target species in this fishery, but are commonly landed. Harvest of species from the nearshore reefs within Monterey Bay and coastal areas adjacent to the bay increased dramatically as the fishery expanded. Over-exploitation of this previously unregulated resource, along with recent regulation, has resulted in a moderate decline in landings for most species.

The Monterey Bay area also supports a moderate-sized crab fishery. Dungeness crab and two species of rock crab are harvested from the Monterey area. Dungeness crab landings vary with the species' abundance near the southern end of its range. Pacific rock crab *Cancer antennarius* and red rock crab *Cancer productus* are typically landed in the combined market category "Unspecified rock crab" or their claws are removed and are landed in the "crab claws" market category.

3.0 IMPINGEMENT STUDY

Field data on the composition and abundance of impinged fishes and selected macroinvertebrates will provide an estimate of the total number and types of these organisms impinged on the intake screens of DEML Units 1&2 and Units 6&7. These data, assuming 100 percent impingement mortality, will be used to estimate impingement losses. The assessment will specifically address the following questions:

- What are the species composition and abundance of juvenile and adult fishes and selected macroinvertebrates impinged by DEML?
- What are the potential impacts of the power plant's cooling water system on juvenile and adult fishes and selected macroinvertebrates?

The sampling program is designed to provide current estimates of the abundance, taxonomic composition, diel periodicity, and seasonality of organisms impinged at DEML. In particular, the study will focus on the rates (i.e., number or biomass of organisms per m^3 water flowing per time into the plant) at which various species of fishes and macroinvertebrates are impinged. The impingement rate is subject to tidal and seasonal influences that vary on several temporal scales (e.g., hourly, daily, and monthly) while the rate of cooling water flow varies with power plant operations and can change at any time.

A review of the previous impingement study at DEML (see Appendix A) provides background information on previous impingement effects. Information from CDFG landings data and studies of the fish assemblages in Elkhorn Slough, Moss Landing Harbor, and Monterey Bay will provide information regarding the marine resources in the area of the power plant and help to assess the impingement effects.

3.1 Methods

3.1.1 Sample Collection

Impingement sampling at Units 1&2 will be scheduled to occur over a 24-hour period once per week for the period of one year. Impingement sampling at the Units 6&7 intake will occur only if one or both of those units are scheduled to operate during any given week during the study period. Over the last two years Units 6&7 have operated less than 15 percent of the time, and it is not anticipated that either unit will operate more frequently during the study period.

The sampling schedule will remain flexible to accommodate the Units 6&7 operating schedules, but the circulating water pumps will not be operated for the sole purpose of accommodating weekly impingement sampling.

Each sampling period will be divided into four 6-hour cycles. Before each weekly sampling effort, all of the screens and the bar racks (if possible) will be cleaned of all impinged debris and organisms. The sluiceways and collection baskets will be cleaned before the start of each sampling effort.

Samples will be collected by rotating and rinsing the impinged material from the Units 1&2 and Units 6&7 (if operating) screens into collection baskets. The screens will remain stationary for a period of approximately 5.5 hours then they will be rotated and washed for 30 minutes. The impinged material from the traveling screens will be rinsed into the collection baskets associated with each set of screens. The debris and organisms rinsed from each set of traveling screens will be kept separate and processed according to the procedures presented in the following section. Material removed by the bar rack rakes will also be collected and processed. The operating status of each circulating water pump during the 6-hour cycle will be recorded on the data sheet.

The sampling at each of the two sets of traveling screens (Units 1&2 and Units 6&7) will be offset by one hour to allow screen wash and collection to occur at each set of screens separately. An example of the daily schedule of screen wash cycles and sample collection is presented in Table 3-1. This schedule assumes the operation of Units 6&7. If Units 6&7 are not in operation, the sampling will be restricted to the Units 1&2 schedule.

If heat treatment, or thermal demusseling, is scheduled during the one-year study period, impingement sampling will occur following the conclusion of the treatment. Procedures for heat treatment will involve clearing and rinsing the traveling screens prior to the start of the heat treatment procedure. At the end of the heat treatment procedure normal pump operation is resumed and the traveling screens rinsed until no more fishes are collected on the screens. Processing of the samples will occur using the same procedures used for normal impingement sampling.

Occasionally, there may be such a large amount of debris collected on the traveling screens that the screens will be continuously rotated and rinsed. If the traveling screens are operating in the continuous mode, then sampling will be coordinated with the intake crew so samples can be collected safely.

Table 3-1. Proposed schedule for 24 hour impingement sampling effort for DEML (schedule assumes that either Unit 6 or Unit 7 is operating).

Time	Units 1&2	Units 6&7
8:00	Rinse and Clean	
8:30	Start Cycle 1	
9:00		Rinse and Clean
9:30		Start Cycle 1
10:00		
10:30		
11:00		
11:30		
12:00		
12:30		
13:00		
13:30		
14:00	Rinse Cycle 1	
14:30	Start Cycle 2	
15:00	Process Cycle 1	Rinse Cycle 1
15:30		Start Cycle 2
16:00		Process Cycle 1
16:30		
17:00		
17:30		
18:00		
18:30		
19:00		
19:30		
20:00	Rinse Cycle 2	
20:30	Start Cycle 3	
21:00	Process Cycle 2	Rinse Cycle 2
21:30		Start Cycle 3
22:00		Process Cycle 2
22:30		
23:00		
23:30		
0:00		
0:30		
1:00		
1:30		
2:00	Rinse Cycle 3	
2:30	Start Cycle 4	
3:00	Process Cycle 3	Rinse Cycle 3
3:30		Start Cycle 4
4:00		Process Cycle 3
4:30		
5:00		
5:30		
6:00		
6:30		
7:00		
7:30		
8:00	Rinse Cycle 4	
8:30	Process Cycle 4	
9:00		Rinse Cycle 4
9:30		Process Cycle 4

Note: Schedule is separated into 30-minute increments to show activities associated with each cleaning and collection cycle at the two sets of traveling screens.

3.1.2 Sample Processing

All fishes, decapod crabs, shrimps and prawns, cephalopod molluscs, and echinoderms collected at the end of each 6-hour cycle will be identified and counted. Table 3-2 presents a summary of the data to be recorded for each of the taxonomic groups selected for study. Any mutilated organisms will be identified to the lowest taxonomic level possible, but their lengths will not be recorded. If field personnel are unable to identify an organism, it will be preserved for identification in the laboratory. The presence of other species such as jellyfish and colonial species such as bryozoans will be recorded on the data sheets.

Table 3-2. Summary of data to be recorded for organisms collected during DEML impingement sampling.

Organism Group	Abundance	Length	Weight	Condition of Specimen
Chrondrichthys (sharks, skates, rays)	X	X	X	X
Osteichthys (bony fishes)	X	X	X	X
Decapod crabs	X	X	X	X
Shrimps	X	X	X	X
Cephalopod molluscs (octopus and squid)	X	X	X	X
Echinoderms	X	X	X	X

Note: - Length measurements will be made to the nearest 1.0 mm.
- Weight measurements will be made to the nearest 0.1 gram.
- Condition will be reported as alive, dead, mutilated, or fragmented.

The measuring criteria for selected organism groups is shown in Table 3-3.

Table 3-3. Measuring criteria* for various groups of organisms that may be impinged at DEML.

Organism Group	Measuring Criteria
Fishes	Total body length for sharks and rays and standard lengths for bony fishes
Crabs	Maximum carapace width
Shrimps	Carapace length, measured from the anterior margin of carapace between the eyes to the posterior margin of the carapace
Gastropod & Pelecypod Molluscs	Maximum shell length or maximum body length
Octopus	Maximum “arm” spread, measured from the tip of one tentacle to the tip of the opposite tentacle
Squid	Maximum body length, measured from the tip of one tentacle to the posterior end of the body
Echinoderms	Test diameter for urchins

*Note: All measurements will be made to the nearest millimeter.

The wet body weight of individual animals will be determined after shaking loose water from the body. Total weight of all individuals combined will be determined in the same manner. All weights will be recorded to the nearest gram. The qualitative body condition of individual fishes and macroinvertebrates will be determined and recorded, using codes for decomposition and physical damage. Other non-target, sessile macroinvertebrates will be identified to species and their presence recorded, but they will not be measured or weighed. Rare occurrences of other impinged animals, such as dead marine birds, will be recorded and their individual weights determined and recorded. The amount and type of debris (e.g., *Mytilus* shell fragments, wood fragments, etc.) and any unusual operating conditions in the screen well system will be noted by writing specific comments in the "Notes" section of the data sheet.

Two measurement procedures are used, depending on the number of individuals of a given target species present in the sample. If the number of individuals per species in the sample or subsample is 30 or less, the linear measurement, weight, and body condition codes for each individual will be determined and recorded. If the number of individuals per species is greater than 30 the following criteria apply:

1. The linear measurement, individual weight, and body condition codes for a subsample of 30 individuals will be recorded on individual lines of the data sheet. The individuals chosen for measurement are selected after spreading out all of the individuals in a sorting container, making sure that they are well mixed and not segregated into size groups. Fragments of organisms are eliminated from consideration since linear measurements would not be representative.

2. The total number and total weight of all the remaining individuals combined will be determined and recorded on a separate line.

The total weight of all impinged detritus will also be recorded during each collection effort either directly or through subsampling if there is a large amount of debris. In addition to data on impinged material, the operating status of the circulating water pumps, data on tide, weather, and sea state conditions will be recorded on the data sheets for each cycle.

A quality control (QC) program will be implemented to ensure the correct identification, enumeration, length and weight measurements of the organisms recorded on the data sheet. Impingement cycles will be randomly chosen for onsite QC re-sort to verify that all the organisms were removed from the impinged material.

3.1.3 Data Processing

Impingement estimates for species and taxonomic groups will be obtained by first calculating the cooling water flow during each screen wash cycle sampled during the 24-hour survey. The total time for each screen wash cycle will be multiplied by the flow rate for Units 1&2 and Units 6&7 (if operating) for that period. The flow rate for each screen wash cycle will be used in calculating an impingement rate based on the total number and weight of organisms for a species or taxonomic group collected during the cycle.

Subsampling will be used to contend with any large influx of a single taxon. If a large number (greater than 30) of individuals from a single taxon are collected during a cycle, 30 individuals will be measured and weighed while the remainder will be counted and batch-weighed. For these taxa, weights and counts for the measured individuals will be totaled and then an average weight per individual will be calculated. The average impingement rate and its associated variance for the 24-hour collection period will be calculated from the rates (number and weight) calculated for the screen wash cycles.

The average impingement rates (number and weight) for each taxon over the 24-hour collection period will be used to obtain estimates of impingement for the entire weekly survey period for each unit group. The days between impingement collections will be assigned to each weekly survey period by using the collection day as the median day within the period and assigning the days on either side of that collection date to create a weekly survey period. In most cases, the weekly survey periods will be 7 days, but when weekly surveys cannot be conducted, the periods will be longer. The total flow for the days within each survey period will be calculated using records of pump operation at the power plant and multiplied by the average impingement rates if actual impingement is being calculated. If impingement under base loaded conditions (continuous, full-power operation) is being calculated, the impingement rates will be multiplied by design pump-flows totaled for the weekly survey period. Finally, the total biomass and abundance estimates for each study period will be summed to obtain annual estimates for each taxon.

3.2 Methods for Estimating Impingement Impacts

Impingement source water impacts will be evaluated using various CDFG catch block and landings data. Impingement rates and biomass estimates will be calculated from actual numbers of organisms impinged and compared to estimates of source water abundance and biomass. Data from the 24-hour collections each week will be multiplied by the number of days between surveys to estimate the total number of organisms impinged in a survey period (typically one week). The same method is used to calculate the weekly and annual biomass. Plant circulating

water pump operating records will provide the data for the volume of water pumped each week used to estimate weekly impingement rates. A final Impingement Characterization Report will be submitted after all analyses are completed. The report will contain life history summaries of the most abundantly impinged fishes and macroinvertebrates and provide the value of any commercially harvested impinged species based on reported market price.

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Duke Energy Moss Landing
Units 1&2 and Units 6&7
Impingement Study Plan

Appendix A

Moss Landing Power Plant 316(b)
1978–1980 Impingement Study Summary

A.1 Introduction

Impingement studies were previously conducted at Moss Landing Power Plant (MLPP) by Pacific Gas and Electric Company, the plant's former owner, from January 1979–March 1980 in order to fulfill the requirement of Section 316(b) of the Clean Water Act. The results of the study were presented in the Moss Landing Power Plant Cooling Water Intake Structures 316(b) Demonstration (PG&E 1983). The impingement study was designed to quantify the composition and abundance of impinged organisms at both Units 1-5 and Units 6&7.

Data presented in this appendix are from impingement studies conducted at the Moss Landing Power Plant in 1979–1980 as part of the first 316(b) Demonstration program (PG&E 1983). Data reported in PG&E (1983) were presented as numbers of organisms caught during each impingement collection. We have obtained the actual cooling water volumes for Units 1-5 and Units 6&7 for the period of the impingement study and have calculated densities of the most abundantly impinged fishes and *Cancer* spp. crabs.

A.2 Methods

Impinged fishes and macroinvertebrates were collected from weekly samples at the intakes of both Units 1-5 and Units 6&7. The impingement study began on January 20, 1979 and continued through March 18, 1980. Samples were taken over a 24-hour period that was divided into either 3- or 6-hour cycles. This cycle-breakdown of sample collection allowed for the determination of the diel distribution of the impinged organisms.

Before each sampling period all the traveling screens were rotated and rinsed to remove previously impinged organisms and debris. The screens remained stationary for 2.75 hours and then were rotated for 15 minutes while impinged organisms were rinsed into a collection basket lined with ¼-inch (0.635 cm) steel mesh. This procedure was repeated for the entire 24-hour sampling period.

The impinged organisms were removed from the detritus. Fishes and macroinvertebrates were identified to species, counted, and measured. The fork length (tip of snout to fork in tail) of the fishes was measured for up to 50 individuals of each species, carapace widths measured for *Cancer* spp. and the mantle length was recorded for squids and octopus.

Gonads of the most commonly impinged fish were periodically examined to assess spawning condition. Gonads were dissected from the fish and classified as undeveloped, developing, mature, or spent.

All samples were subjected to a Quality Control program that called for resorting sample debris and reidentification of the collected organisms. Sampling efficiency was also tested in various experiments. Marked dead fish were released directly in front of the intakes and the number of recovered fishes was recorded. Eighty-seven percent of the dead fish released into the Units 1-5 intake were recovered in this test of sampling efficiency but only 35 percent were recovered from Units 6&7. The low recovery rate for Units 6&7 was attributed to a traveling screen design that was built to remove jellyfish, kelp, and algae. This system consists of L-shaped brackets or cylindrical projections attached to the traveling screens. These brackets interfered with the effectiveness of the spraywash system and some of the impinged material was carried over and bypassed the secondary sluiceway. It was observed that this "carry-over" occurred when there was insufficient water pressure. The differential collection efficiencies between the two intakes were taken into consideration when impingement characteristics were compared.

A.3 Results

A.3.1 Fishes

Northern anchovy *Engraulis mordax* was the most abundant fish species collected from both intakes and constituted 61 percent of all fishes impinged. Shiner perch *Cymatogaster aggregata* ranked second in abundance at 9 percent, followed by topsmelt *Atherinops affinis* (9 percent) and Pacific herring *Clupea pallasi* (4 percent). These four species accounted for 83 percent of all fishes impinged during the entire study.

Northern anchovy was impinged in highest numbers during the summer and early fall months and were present in very low numbers during the winter. Peak impingement occurred in late August and early September at both intakes: n=19,077 at Units 1-5 and n=90,160 at Units 6&7. Based on laboratory growth rates, it was surmised that the northern anchovy impinged during the summer and fall were spawned during the previous spring.

Shiner perch was the second most abundant fish collected at Units 1-5 (n=26,000) and the fourth most abundant at Units 6&7. They were collected throughout the year but peaked during their spawning period in the spring and summer months. Shiner perch are live-bearers and the majority of shiners impinged were young-of-the-year. It was thought that gravid females may have prematurely released their embryos when the came into contact with the screens.

Topsmelt was the third most abundantly impinged fish at Units 1-5 (n=13,000) and the second most abundant at Units 6&7 (n=16,000); overall this species constituted 8.8 percent of all fishes collected. They were impinged throughout the year, with peak abundance from October through

December. Large schools of topsmelt, which may have been associated with spawning activity, were observed in the harbor during the fall and early winter.

Pacific herring was the fourth most abundantly impinged fish and constituted 4.3 percent of all fishes impinged. They were impinged throughout the year with peak densities from June through August, with a second, lower peak in January and February.

Thirteen species of surfperch were collected in impingement samples from the Units 1-5 intake, and 12 species from the Units 6&7 intake. Shiner perch discussed above was the most commonly collected species at both intakes. Other species included white seaperch, and barred, black, dwarf, kelp, pile, rainbow, rubberlip, silver, spotfin, striped, and walleye surfperches. Walleye surfperch were collected throughout the year, with peak numbers impinged in June and July. Most were impinged in the summer and were juveniles. White seaperch was impinged also throughout the year with peaks in abundance between May and July and were mainly juveniles.

Rockfishes were represented in impingement collections by a total of 14 species. The most abundant were olive, blue, grass, and brown rockfish and bocaccio. These five species accounted for 89 percent of all rockfishes impinged at Units 1-5 and 84 percent at Units 6&7. The percentage of bocaccio, the single most abundant rockfish impinged, at Units 1-5 (59 percent) was nearly the same at Units 6&7 (53 percent). Bocaccio was impinged throughout the year, with the greatest abundance in May through September.

On the basis of the lengths of impinged bocaccio, it was determined that virtually all were young-of-the-year. The data showed that mean length of the bocaccio measured was less than 180 mm, the maximum length of the young-of-the-year bocaccio (Starr et al. 1998).

Olive/yellowtail rockfish constituted 14 percent of the rockfish collected from Units 1-5 intake and 16 percent at Units 6&7. They were collected throughout the year with peak abundance in June and July. Blue rockfish comprised 6 percent of rockfish collected at Units 1-5 and 4 percent at Units 6&7. The average length for the Units 1-5 was 70 mm (2.8 in.) and 67 mm (2.6 in.) at Units 6&7. As with the olive/yellowtail, virtually all blue rockfish impinged were juveniles.

Figure A-1 shows the mean monthly concentrations (#/1,000 m^3) for the four most abundantly impinged fishes: northern anchovy, shiner perch, topsmelt, and Pacific herring. The mean monthly concentration was determined by calculating the mean concentration for all of the surveys taken during that month. The survey data illustrated that the highest impingement for the northern anchovy occurred during the late summer and fall. Impingement for shiner perch

was high during the summer, whereas topsmelt experienced the highest impingement during the late fall.

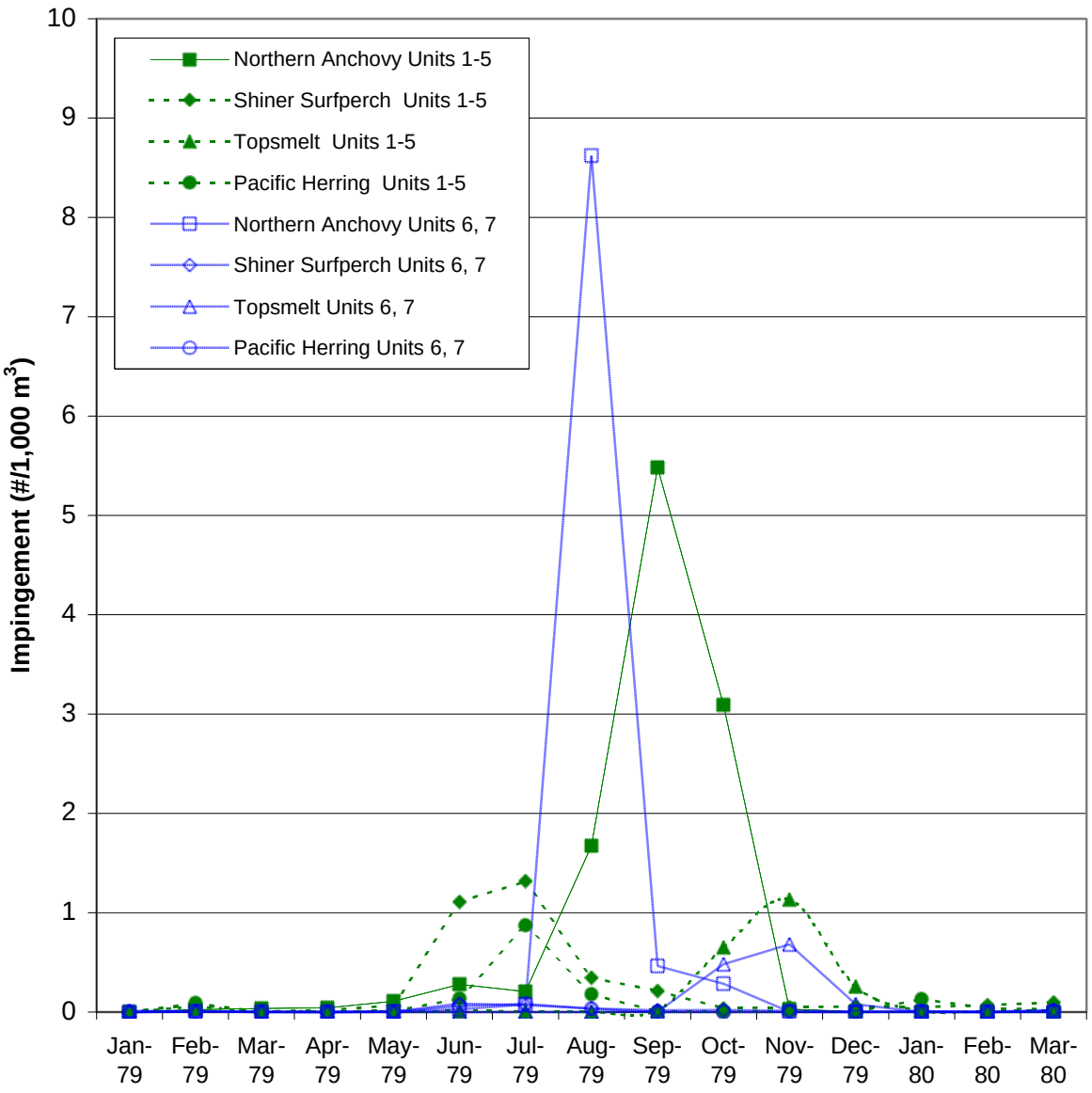

Figure A-1. Mean monthly concentrations of the most abundantly impinged fishes at the Moss Landing Power Plant Units 1-5 and Units 6&7 intakes (PG&E 1983).

Figures A-2a and A-2b also show the mean monthly concentrations for the abundantly impinged fishes. However in these figures, the concentration for each of the four species is presented in one record per month. This provides an indication of the total impingement for all abundant fishes as well as the contribution to the total by each of the four species. These figures further illustrate that the highest concentration occurs during the summer and fall seasons.

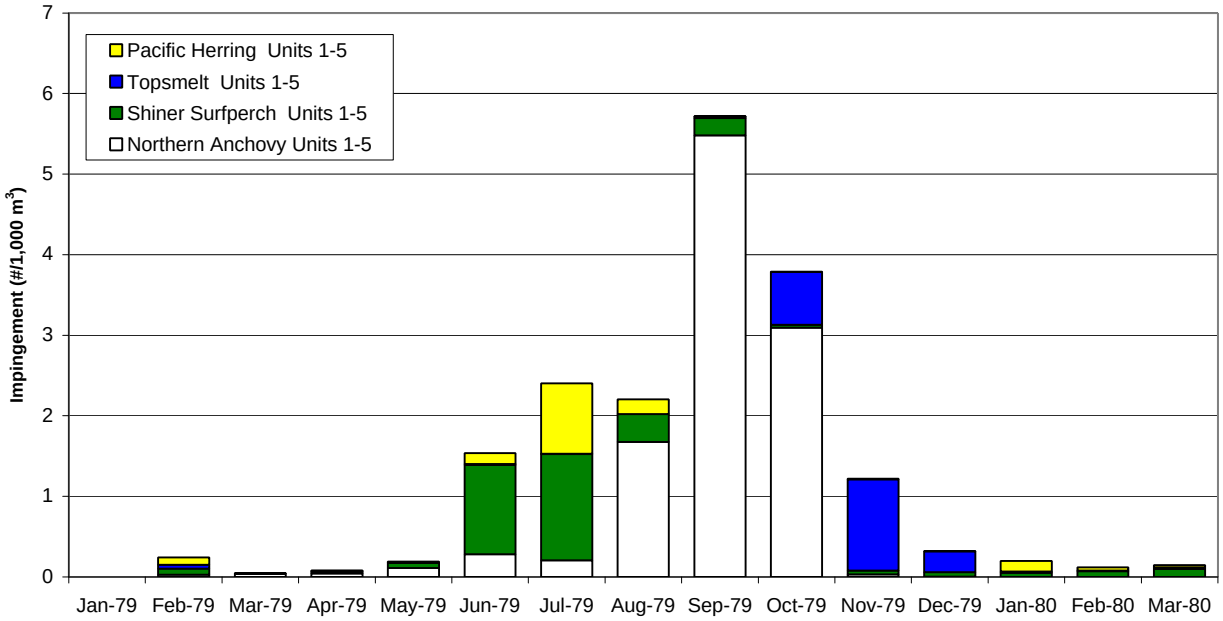

Figure A-2a. Mean monthly combined concentrations of the most abundantly impinged fishes at the Moss Landing Power Plant Units 1-5 intake (PG&E 1983).

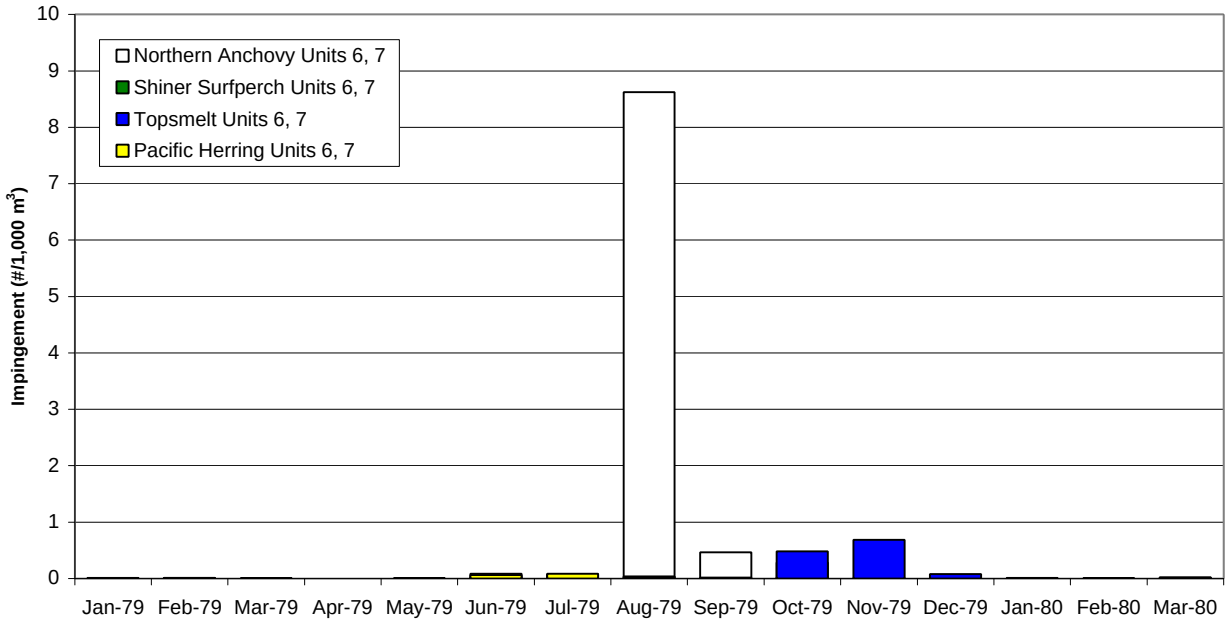

Figure A-2b. Mean monthly combined concentrations of the most abundantly impinged fishes at the Moss Landing Power Plant Units 6&7 intake (PG&E 1983).

A.3.2 Macroinvertebrates

The majority (62 percent) of the total macroinvertebrates impinged by both MLPP intakes was collected from Units 1-5. *Cancer* spp. crabs constituted 37 percent of the total number of macroinvertebrates impinged at Units 1-5 and 9 percent at Units 6&7. *Crangon* spp. shrimps constituted 19 percent of the total number impinged at Units 1-5 and 31 percent at Units 6&7. The species composition of impinged organisms was generally similar between the two intakes.

The most abundantly impinged shrimp species were three species of bay shrimp: *Crangon nigricauda* (17 percent of the total macroinvertebrates impinged), *Crangon nigromaculata* (7 percent), and *Lissocrangon stylirostris* (7 percent). All three species were collected throughout the year with peak abundance during the winter storm period. They were impinged primarily at night. Other species of shrimp such as *Pandalus danae*, *Upogebia pugettensis*, and *Peneus californiensis* were impinged in relatively low numbers.

Seven species of cancer crabs were impinged in the following order of abundance: 1) *Cancer antennarius, C. anthonyi, C. productus, C. gracilis, C. magister, C. jordani, and C. oregonesis*. All of these crab species were impinged in substantially higher numbers at Units 1-5. Three species (*Cancer antennarius, C. anthonyi, C. productus)* were collected in the greatest numbers and accounted for 37 percent of the catch at Units 1-5 but only 9 percent were collected at Units 6&7. *Cancer antennarius* was the most abundant (21 percent) of all macroinvertebrates

impinged. The frequency of collection of small *Cancer antennarius* suggested that Moss Landing Harbor/Elkhorn Slough provide a nursery habitat for juvenile crabs. *C. anthonyi* constituted approximately 4 percent of all macroinvertebrates impinged. The peak abundance in April was composed of juvenile crabs. *C. productus* constituted less than 2 percent of the total number of macroinvertebrates impinged. Again, the peak in abundance (June) was represented by the presence of small crabs. Dungeness crab was collected in low numbers (24 crabs from Units 1-5 and 27 crabs from Units 6&7) throughout the year.

Squid constituted less than 5 percent of the total number of macroinvertebrates impinged at the Units 1-5 intake and 3 percent at Units 6&7. They were collected in every month and did not display a seasonal pattern. The peak number of crabs and squid were impinged in June at Units 1-5 (68 individuals) and in October at Units 6&7 (70 individuals).

Figures A-3a and A-3b show the mean monthly concentrations for three selected cancer crabs; *Cancer antennarius*, *Cancer anthonyi*, and *Cancer productus*. These figures show that *Cancer antennarius* experienced the highest impingement. *Cancer anthonyi* had the next highest impingement levels throughout the survey period.

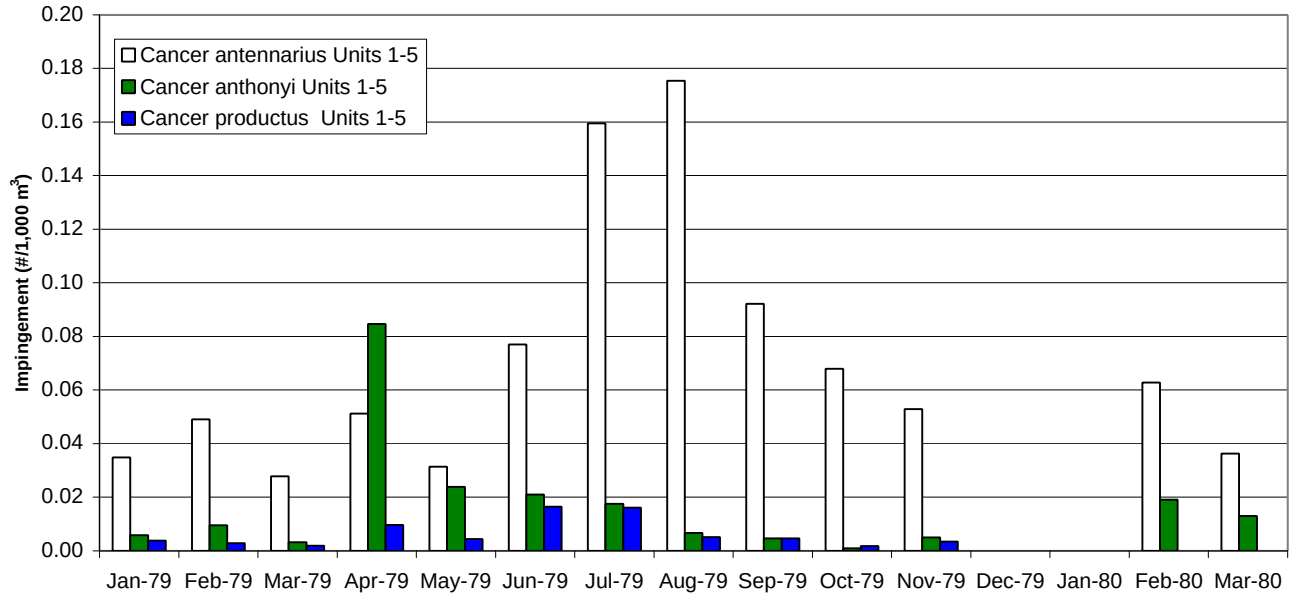

Figure A-3a. Mean monthly concentrations of the most abundantly impinged *Cancer* spp. crabs at the Moss Landing Power Plant Units 1-5 intake (PG&E 1983).

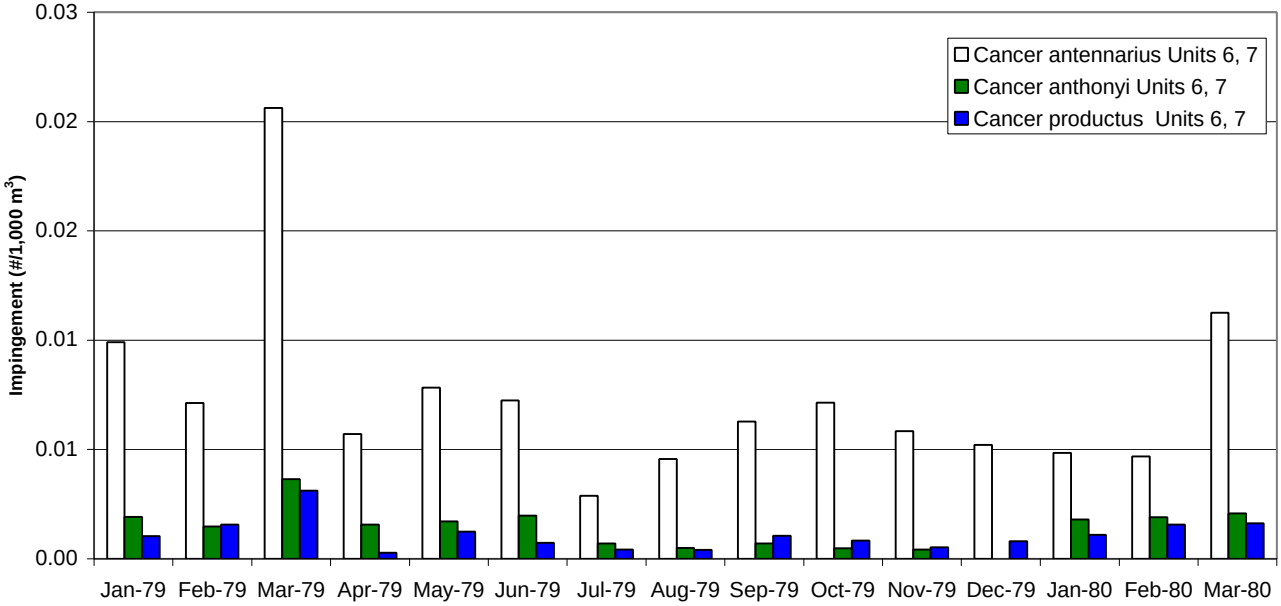

Figure A-3b. Mean monthly concentrations of the most abundantly impinged *Cancer* spp. crabs at the Moss Landing Power Plant Units 6&7 intake (PG&E 1983).

A.3.3 Estimated Concentrations

Table A-1 lists the estimated concentrations (#/1,000 m^3) based on surveys taken from January 1979–March 1980. Impingement surveys were taken at the cooling water intakes for Units 1-5 and Units 6&7. The data for the surveys were used to calculate an estimated concentration and estimated number impinged per day for selected species of fish and macroinvertebrates at each intake.

Table A-1. Estimated concentrations based on surveys taken from January 1, 1979–March 31, 1980.

	Units 1-5		**Units 6&7**	
Mean Volume/Day - Survey Dates (1,000 m^3)	1,330		2,322	
Mean Volume/Day - Calendar Year (1,000 m^3)	1,267		2,335	
	Estimated Concentration (#/1,000 m^3)	Estimated Impinged/Day (#)	Estimated Concentration (#/1,000 m^3)	Estimated Impinged/Day (#)
Northern anchovy	0.7882	1,049	0.7230	1,678
Shiner perch	0.3099	412	0.2378	552
Topsmelt	0.1542	205	0.1470	341
Pacific herring	0.1330	177	0.1088	253
Pacific staghorn sculpin	0.0569	76	0.0523	121
Bocaccio	0.0644	86	0.0466	108
Rockfish: black rockfish, chilipepper, copper rockfish, cowcod, darkblotched rockfish, dwarf rockfish, kelp rockfish, shortbelly rockfish, vermilion rockfish.	0.0009	1	0.0008	2
Abundant Fishes: northern anchovy, shiner perch, topsmelt, and Pacific herring.	1.3854	1,843	1.2166	2824
Crabs: *Cancer antennarius, Cancer anthonyi, Cancer gracilis, Cancer jordani, Cancer magister, Cancer oregonensis, Cancer productus, Cancer* spp.	0.1135	151	0.1019	237

Selected species of fishes include abundant fish such as northern anchovy, shiner perch, topsmelt, and Pacific herring. The staghorn sculpin and bocaccio were of interest and were also included in the impingement analysis. Selected rockfish were analyzed as a group including black rockfish, chilipepper, copper rockfish, cowcod, darkblotched rockfish, dwarf rockfish, kelp rockfish, shortbelly rockfish, and vermilion rockfish. Selected species of cancer crabs were analyzed including *Cancer antennarius*, *Cancer anthonyi*, *Cancer gracilis*, *Cancer jordani*, *Cancer magister*, *Cancer oregonensis*, *Cancer productus*, and *Cancer* spp.

The estimated concentration was determined by first calculating the actual concentration for each survey. The estimated concentration was then calculated by taking the mean of the concentration for all of the surveys. The mean cooling water intake volume for all the survey dates was utilized to convert the estimated concentration to an estimated number impinged per day. The

estimated number of each species impinged per day was calculated by taking the product of the estimated concentration and the mean volume for all of the surveys.

The northern anchovy had the highest estimated concentration of the selected abundant fish for Units 1-5 and Units 6&7 (at 0.7882 and 0.7230 /1,000 m^3 respectively). The topsmelt had the second highest estimated concentration at 0.3099/1,000 m^3 for Units 1-5 and 0.2378 /1,000 m^3 for Units 6&7. Shiner perch had the third highest estimated concentration at 0.1542 and 0.1470/1,000 m^3 for Units 1-5 and Units 6&7 respectively. Pacific herring had the fourth highest estimated concentration at 0.1330 and 0.1088 /1,000 m^3.

The remaining species of fish analyzed had relatively low concentrations. Staghorn sculpin had an estimated concentration at 0.0569 (#/1,000 m^3) for Units 1-5 and 0.0523 /1,000 m^3 for Units 6&7. Bocaccio had an estimated concentration at 0.0644 and 0.0466 /1,000 m^3 respectively for Units 1-5 and Units 6&7. The selected rockfish had an extremely low estimated concentration of 0.0009 /1,000 m^3 and 0.0008 /1,000 m^3) for Units 1-5 and Units 6&7.

The data for the cancer crabs were evaluated as a group. The estimated concentration for the cancer crabs was 0.1135/1,000 m^3 for Units 1-5 and 0.1019/1,000 m^3 for Units 6&7.

A.4 Impingement Survival

Impingement survival studies were designed to provide a quantitative basis for estimating the survival of fishes and macroinvertebrates (PG&E 1983). Impingement survival was determined for the following three modes of traveling screen rotation operation: continuous, 1-hour intermittent, and 3-hour intermittent. The different rotation modes limited the amount of time impinged organisms were held on the screens. Organisms were collected and initial observations of alive or dead were recorded. Animals were placed into a flow-through holding system containing ambient water. They were observed periodically throughout the 96-hour holding period. Control experiments were conducted to determine the mortality associated with the sluiceway collection, handling, and the holding systems methods used. Fishes were mainly collected from otter trawls conducted in Moss Landing Harbor. These control fishes were held for 2 to 4 days before testing to allow them to recover from collection and handling stresses.

A.4.1 Results

Initial and long-term survival of northern anchovy, Pacific herring and silversides were characteristically low at both intakes. Increasing the frequency of screen rotation improved the survival of surfperch at Units 6&7 but did not have much effect at Units 1-5. Although the survival of flatfish increased with increased screen rotation, the numbers of fishes available for

testing were low. Long-term survival of gobies and sculpin was high after the 3-hour rotation. Survival of crabs was high from Units 6&7, although the number tested was small; Units 1-5 crab survival was only 47 percent with 3-hour rotation, which increased to 70 percent and 74 percent for the 1-hour and continuous rotation mode, respectively. It is important to note that these studies were done on organisms collected from the sluiceways of the intakes and were not performed on organisms returned to the Units 6&7 discharge. Impinged material from Units 1-5 was not routed out through the discharge in Elkhorn Slough, thus no impinged organisms survived.

A.5 Conclusions

The authors of the 316(b) Demonstration (PG&E 1983) used trends in the commercial fishery landing statistics for the Monterey Bay region to assess impingement effects. For example, the trend in commercial landings of northern anchovy, the most abundantly impinged and entrained fish, was showing a general increase during the 1970s. Northern anchovy was also the largest (in terms of biomass) fishery in California during the time of the 1979–1980 316(b) work. It was concluded that it was unlikely that the northern anchovy population could have supported such an increased commercial harvest trend if entrainment and impingement had precluded the maintenance of the existing population. Northern anchovy are a pelagic schooling species found from Baja California, north to Alaska. It was also noted that due to the broad distribution and high reproductive potential of northern anchovy, they appeared to be capable of sustaining the incremental mortality associated with a large commercially harvested species.

Gobies are bottom-dwelling or burrow-inhabiting fishes found in the subtidal and intertidal areas in the vicinity of the MLPP. Several species of gobies have been collected in larval and adult fish surveys of the area (Nybakken, Cailliet, and Broenkow 1977). These species include: bay goby, arrow goby, blackeye goby, yellowfin goby, and longjaw mudsucker. There is no commercial fishery for gobies. Because no information existed on trends in abundance and distribution, the authors used life history information to assess potential impacts. They reported, from the literature, that gobies have a moderately high reproductive potential, a high natural mortality rate, are widely distributed, and are not subjected to sport or commercial harvesting. It was also noted that extensive habitat exists in the vicinity of the plant and that because of their bottom-dwelling habits, very few reproductive adults were susceptible to impingement.

Therefore, it was concluded that the impingement losses for species considered were negligible for the MLPP. No trends were found in the area's commercial and sport fisheries, including those near the plant, to indicate an adverse impact due to impingement losses at the power plant. Since impingement effects on area-wide fisheries were qualitatively undetectable, it was

concluded that existing MLPP intake technology represented BTA to minimize impingement effects and potential impacts.

A.6 Literature Cited

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Moss Landing Power Plant
Impingement Study Data Report

Appendix B

Impingement Survey Data

Table B-1. Moss Landing Power Plant Impingement Survey 01, November 9, 2005.

Taxon	Common Name	Units 1& 2* Count	Length Range (mm)	Length Average (mm)	Weight Range (g)	Weight Average (g)	Units 6&7 Count	Length Range (mm)	Length Average (mm)	Weight Range (g)	Weight Average (g)
FISHES											
Acanthogobius flavimanus	yellowfin goby	1	125	125.0	23.8	23.8	Not operating, therefore no sampling.				
Artedius corallinus	coralline sculpin	1	71	71.0	7.3	7.3					
Atherinops affinis	topsmelt	3	49-99	66.0	0.8-9.2	3.6					
Chilara taylori	spotted cusk-eel	1	169	169.0	19.8	19.8					
Citharichthys stigmaeus	speckled sanddab	6	29-90	50.3	<0.1-11.8	3.6					
Clevelandia ios	arrow goby	26	43-59	48.5	0.5-1.5	0.9					
Cymatogaster aggregata	shiner surfperch	1	87	87.0	12.4	12.4					
Engraulis mordax	northern anchovy	2	67-79	73.0	2.3-3.2	2.8					
Gasterosteus aculeatus	threespine stickleback	3	24-39	33.3	<0.1-0.7	0.4					
Lepidogobius lepidus	bay goby	2	75-85	80.0	5.0-7.2	6.1					
Leptocottus armatus	Pacific staghorn sculpin	3	115-120	117.3	30.6-35.4	32.8					
Neoclinus uninotatus	onespot fringehead	1	87	87.0	6.3	6.3					
Porichthys notatus	plainfin midshipman	57	29-64	47.3	0.4-2.9	1.3					
Symphurus atricauda	California tonguefish	15	85-128	96.3	4.8-20.4	8.1					
Syngnathus spp.	pipefishes	28	40-259	165.6	<0.1-4.8	1.9					
INVERTEBRATES											
Cancer antennarius	brown rock crab	3	55-77	66.0	38.7-100.3	68.6					
Cancer gracilis	slender crab	3	36-52	44.0	10.6-20.6	15.6					
Cancer jordani	hairy rock crab	1	56	56.0	32.0	32.0					
Cancer productus	red rock crab	5	13-116	49.8	0.3-211.3	56.3					
Cancer spp.	cancer crabs	3	21-29	25.0	2.5-4.8	3.7					
Crangon franciscorum	Franciscan bay shrimp	14	7-18	13.7	0.4-4.2	2.3					
Crangon nigricauda	black-tailed bay shrimp	21	8-17	12.8	0.6-4.0	2.2					
Crangon nigromaculata	spotted bay shrimp	46	7-18	12.4	0.4-6.3	2.4					
Hemigrapsus oregonensis	yellow shore crab	3	10-16	13.7	0.5-3.4	1.8					
Heptacarpus spp.	tidepool shrimps	2	5-7	6.0	<0.1-0.3	0.2					
Heptacarpus stimpsoni	Stimpson's shrimp	1	6	6.0	0.3	0.3					
Loligo opalescens	market squid	1	240	240.0	42.3	42.3					
Pachygrapsus crassipes	striped shore crab	13	11-23	17.3	0.6-6.4	2.5					
Pandalus platyceros	spot shrimp	1	21	21.0	5.5	5.5					
Pugettia producta	northern kelp crab	3	13-59	33.3	0.6-55.3	21.7					

*Totals for Units 1&2 include bar rack sample totals.

Table B-2. Moss Landing Power Plant Impingement Abundance Survey 02, November 16, 2005.

		Units 1&2*					Units 6&7				
			Length		Weight			Length		Weight	
Taxon	Common Name	Count	Range (mm)	Average (mm)	Range (g)	Average (g)	Count	Range (mm)	Average (mm)	Range (g)	Average (g)
FISHES											
Acanthogobius flavimanus	yellowfin goby	3	76-129	94.3	4.8-24.6	11.8	Not operating, therefore no sampling.				
Artedius spp.	sculpins	2	62-77	69.5	5.3-10.0	7.7					
Atherinops affinis	topsmelt	1	89	89.0	7.3	7.3					
Citharichthys stigmaeus	speckled sanddab	2	97-99	98.0	14.7-17.1	15.9					
Clevelandia ios	arrow goby	43	39-57	48.7	0.5-2.0	1.1					
Clupea pallasii	Pacific herring	1	74	74.0	2.8	2.8					
Engraulis mordax	northern anchovy	1	62	62.0	1.7	1.7					
Gasterosteus aculeatus	threespine stickleback	2	32	32.0	0.3	0.3					
Gobiidae unid.	gobies	1	27	27.0	0.0	0.0					
Lepidogobius lepidus	bay goby	1	55	55.0	2.8	2.8					
Leptocottus armatus	Pacific staghorn sculpin	5	113-128	122.4	19.5-34.9	30.8					
Liparis spp.	snailfishes	1	31	31.0	0.4	0.4					
Odontopyxis trispinosa	pygmy poacher	2	49-69	59.0	0.4-2.0	1.2					
Platichthys stellatus	starry flounder	1	125	125.0	39.8	39.8					
Porichthys notatus	plainfin midshipman	14	35-55	43.1	0.4-1.5	0.9					
Sardinops sagax	Pacific sardine	2	80-86	83.0	3.5-4.4	4.0					
Syngnathus spp.	pipefishes	15	37-243	179.0	0.5-5.0	2.2					
unidentified fish, damaged	unidentified damaged fish	1	-	-	3.6	3.6					
INVERTEBRATES											
Cancer antennarius	brown rock crab	9	43-96	59.3	11.2-192.3	61.2					
Cancer anthonyi	yellow crab	1	79	79.0	73.2	73.2					
Cancer gracilis	slender crab	1	33	33.0	7.3	7.3					
Cancer jordani	hairy rock crab	1	21	21.0	2.1	2.1					
Cancer productus	red rock crab	2	18-49	33.5	0.8-19.2	10.0					
Crangon franciscorum	Franciscan bay shrimp	11	7-16	12.6	0.4-2.8	1.8					
Crangon nigricauda	black-tailed bay shrimp	30	6-14	10.3	0.1-3.4	1.3					
Crangon nigromaculata	spotted bay shrimp	19	9-16	12.7	0.6-3.7	2.2					
Crangon spp.	bay shrimp	1	-	-	-	-					
Grapsidae unid.	shore crabs	2	4	4.0	<0.1	<0.1					
Hemigrapsus oregonensis	yellow shore crab	6	11-26	14.5	0.7-4.2	1.7					
Heptacarpus spp.	tidepool shrimps	3	5-7	6.0	0.1-0.6	0.3					
Loligo opalescens	market squid	1	67	67.0	2.5	2.5					
Lophopanopeus spp.	black-clawed crabs	1	24	24.0	6.7	6.7					
Pachygrapsus crassipes	striped shore crab	8	12-33	19.7	1.4-7.3	3.5					
Pandalus platyceros	spot shrimp	1	39	39.0	6.0	6.0					
Panulirus interruptus	California spiny lobster	2	7-8	7.5	<0.1-0.1	0.1					
Pugettia producta	northern kelp crab	9	11-30	17.2	0.6-11.0	3.4					

*Totals for Units 1&2 include bar rack sample totals.

Table B-3. Moss Landing Power Plant Impingement Abundance Survey 03, November 22, 2005.

Taxon	Common Name	Units 1&2* Count	Length Range (mm)	Length Average (mm)	Weight Range (g)	Weight Average (g)	Units 6&7 Count	Length Range (mm)	Length Average (mm)	Weight Range (g)	Weight Average (g)
FISHES											
Atherinops affinis	topsmelt	1	73	73.0	3.3	3.3	Not operating, therefore no sampling.				
Citharichthys spp.	sanddabs	1	-	-	-	-					
Citharichthys stigmaeus	speckled sanddab	5	41-94	57.4	0.7-14.7	4.4					
Clevelandia ios	arrow goby	7	41-54	48.3	0.6-1.6	1.0					
Clupea pallasii	Pacific herring	1	71	71.0	2.7	2.7					
Cymatogaster aggregata	shiner surfperch	1	72	72.0	8.1	8.1					
Gasterosteus aculeatus	threespine stickleback	2	27	27.0	<0.1	<0.1					
Lepidogobius lepidus	bay goby	3	70-90	80.0	3.4-6.2	5.0					
Leptocottus armatus	Pacific staghorn sculpin	2	110-121	115.5	21.3-28.5	24.9					
Porichthys notatus	plainfin midshipman	46	28-67	49.4	0.2-3.6	1.4					
Rhinogobiops nicholsi	blackeye goby	1	28	28.0	<0.1	<0.1					
Sardinops sagax	Pacific sardine	1	79	79.0	3.9	3.9					
Sebastes spp.	rockfishes	1	57	57.0	2.9	2.9					
Symphurus atricauda	California tonguefish	7	85-98	94.7	6.3-9.5	8.2					
Syngnathus spp.	pipefishes	26	97-220	158.2	0.2-3.9	1.4					
unidentified fish, damaged	unidentified damaged fish	1	25	25.0	-	-					
INVERTEBRATES											
Cancer antennarius	brown rock crab	10	15-73	47.7	1.1-94.4	35.6					
Cancer anthonyi	yellow crab	1	25	25.0	2.7	2.7					
Cancer jordani	hairy rock crab	2	21-33	27.0	2.4-7.8	5.1					
Cancer productus	red rock crab	3	49-56	52.5	17.5-24.6	21.1					
Cancer spp.	cancer crabs	1	18	18.0	1.2	1.2					
Chionoecetes tanneri	grooved tanner crab	1	159	159.0	300.0	300.0					
Crangon franciscorum	Franciscan bay shrimp	31	12-20	15.1	1.5-4.7	2.5					
Crangon nigricauda	black-tailed bay shrimp	31	7-15	10.6	0.3-4.4	1.5					
Crangon nigromaculata	spotted bay shrimp	38	7-16	11.8	0.4-3.7	1.9					
Crangon spp.	bay shrimp	1	-	-	-	-					
Grapsidae unid.	shore crabs	5	3	3.0	<0.1	<0.1					
Hemigrapsus oregonensis	yellow shore crab	3	9-19	14.7	0.5-2.4	1.6					
Loxorhynchus crispatus	moss crab	1	20	20.0	6.8	6.8					
Pachygrapsus crassipes	striped shore crab	4	15-20	18.3	1.3-4.5	3.1					
Pugettia producta	northern kelp crab	2	11-25	18.0	1.4-6.2	3.8					
Pugettia richii	cryptic kelp crab	1	12	12.0	1.1	1.1					

*Totals for Units 1&2 include bar rack sample totals.

Table B-4. Moss Landing Power Plant Impingement Abundance Survey 04, November 30, 2005.

Taxon	Common Name	Units 1&2* Count	Length Range (mm)	Length Average (mm)	Weight Range (g)	Weight Average (g)	Units 6&7 Count	Length Range (mm)	Length Average (mm)	Weight Range (g)	Weight Average (g)
FISHES											
Acanthogobius flavimanus	yellowfin goby	1	148	148.0	45.0	45.0	Not operating, therefore no sampling.				
Artedius lateralis	smoothhead sculpin	2	77-101	89.0	6.9-25.0	16.0					
Artedius notospilotus	bonyhead sculpin	1	59	59.0	5.2	5.2					
Atherinops affinis	topsmelt	1	76	76.0	4.0	4.0					
Citharichthys spp.	sanddabs	2	31	31.0	0.2	0.2					
Citharichthys stigmaeus	speckled sanddab	2	34-45	39.5	0.4-1.1	0.8					
Clevelandia ios	arrow goby	12	47-58	52.9	0.8-1.4	1.1					
Gasterosteus aculeatus	threespine stickleback	1	30	30.0	0.2	0.2					
Gobiidae unid.	gobies	1	23	23.0	-	-					
Lepidogobius lepidus	bay goby	1	79	79.0	3.9	3.9					
Leptocottus armatus	Pacific staghorn sculpin	4	117-123	121.0	23.2-36.3	27.3					
Neoclinus uninotatus	onespot fringehead	1	102	102.0	8.6	8.6					
Platichthys stellatus	starry flounder	1	98	98.0	16.0	16.0					
Porichthys notatus	plainfin midshipman	31	33-74	45.6	0.3-3.8	1.1					
Scorpaenichthys marmoratus	cabezon	1	187	187.0	189.7	189.7					
Symphurus atricauda	California tonguefish	4	87-103	93.5	7.1-36.0	14.5					
Syngnathus spp.	pipefishes	52	88-228	154.7	0.1-4.2	1.4					
Torpedo californica	Pacific electric ray	1	171	171.0	147.7	147.7					
INVERTEBRATES											
Blepharipoda occidentalis	spiny mole crab	1	17	17.0	8.1	8.1					
Cancer antennarius	brown rock crab	20	12-81	45.2	0.5-99.3	35.5					
Cancer anthonyi	yellow crab	1	12	12.0	0.4	0.4					
Cancer jordani	hairy rock crab	7	10-19	13.9	0.2-2.9	1.3					
Cancer productus	red rock crab	6	15-59	27.2	0.6-34.7	8.1					
Crangon franciscorum	Franciscan bay shrimp	10	9-15	11.7	1.2-4.0	1.9					
Crangon nigricauda	black-tailed bay shrimp	14	5-12	9.2	0.3-3.1	1.5					
Crangon nigromaculata	spotted bay shrimp	41	6-15	9.1	0.5-3.7	1.5					
Emerita analoga	mole crab	1	9	9.0	0.6	0.6					
Hemigrapsus oregonensis	yellow shore crab	8	7-13	9.8	0.3-1.1	0.7					
Heptacarpus spp.	tidepool shrimps	6	3-7	5.0	0.1-0.5	0.4					
Pachygrapsus crassipes	striped shore crab	4	10-20	14.8	0.4-4.8	2.3					
Pandalus danae	dock shrimp	2	20-23	21.5	6.2-7.6	6.9					
Panulirus interruptus	California spiny lobster	2	7	7.0	-	-					
Pugettia producta	northern kelp crab	16	6-53	18.8	0.6-82.7	8.9					

*Totals for Units 1&2 include bar rack sample totals.

Table B-5. Moss Landing Power Plant Impingement Abundance Survey 05, December 7, 2005.

Taxon	Common Name	Units 1&2* Count	Length Range (mm)	Length Average (mm)	Weight Range (g)	Weight Average (g)	Units 6&7 Count	Length Range (mm)	Length Average (mm)	Weight Range (g)	Weight Average (g)
FISHES											
Acanthogobius flavimanus	yellowfin goby	3	82-163	132.3	5.7-48.7	31.2	Not operating, therefore no sampling.				
Artedius harringtoni	scalyhead sculpin	2	72-75	73.5	10.7-10.8	10.8					
Artedius notospilotus	bonyhead sculpin	3	55-64	60.0	3.0-6.2	4.6					
Atherinops affinis	topsmelt	3	68-105	91.7	2.6-10.7	7.9					
Atherinopsidae unid.	silversides	1	-	-	-	-					
Cebidichthys violaceus	monkeyface eel	1	285	285.0	149.7	149.7					
Citharichthys stigmaeus	speckled sanddab	14	36-57	47.3	0.6-3.0	1.7					
Clevelandia ios	arrow goby	19	45-56	50.1	0.8-1.5	1.1					
Cymatogaster aggregata	shiner surfperch	1	75	75.0	9.4	9.4					
Engraulis mordax	northern anchovy	1	83	83.0	4.3	4.3					
Gasterosteus aculeatus	threespine stickleback	1	38	38.0	1.5	1.5					
Lepidogobius lepidus	bay goby	2	79-91	85.0	5.4-7.0	6.2					
Leptocottus armatus	Pacific staghorn sculpin	2	115-167	141.0	29.4-84.0	56.7					
Parophrys vetulus	English sole	1	70	70.0	4.5	4.5					
Platichthys stellatus	starry flounder	1	162	162.0	86.9	86.9					
Porichthys notatus	plainfin midshipman	290	35-75	51.5	0.5-4.8	1.7					
Rhinogobiops nicholsi	blackeye goby	4	35-60	51.5	0.7-3.3	2.4					
Ruscarius creaseri	roughcheek sculpin	1	40	40.0	1.9	1.9					
Sardinops sagax	Pacific sardine	3	67-81	76.0	2.5-4.2	3.5					
Scorpaenichthys marmoratus	cabezon	1	129	129.0	51.5	51.5					
Sebastes auriculatus	brown rockfish	3	62-75	68.7	4.8-9.0	7.3					
Symphurus atricauda	California tonguefish	14	81-112	92.5	4.9-13.0	6.8					
Syngnathus spp.	pipefishes	32	96-301	171.2	0.2-7.3	1.9					
INVERTEBRATES											
Blepharipoda occidentalis	spiny mole crab	1	19	19.0	6.1	6.1					
Cancer antennarius	brown rock crab	5	24-78	59.6	3.5-108.8	62.0					
Cancer anthonyi	yellow crab	3	32-34	33.3	6.6-7.8	7.1					
Cancer gracilis	slender crab	6	20-60	42.6	1.3-41.0	18.2					
Cancer jordani	hairy rock crab	2	9	9.0	0.2	0.2					
Cancer productus	red rock crab	9	19-70	47.3	0.4-51.0	20.3					
Crangon franciscorum	Franciscan bay shrimp	40	11-19	15.4	1.0-4.9	2.8					
Crangon nigricauda	black-tailed bay shrimp	154	4-16	11.5	0.4-3.9	1.6					

*Totals for Units 1&2 include bar rack sample totals.

(continued)

Table B-5 continued. Moss Landing Power Plant Impingement Abundance Survey 05, December 7, 2005.

Taxon	Common Name	Units 1&2* Count	Length Range (mm)	Length Average (mm)	Weight Range (g)	Weight Average (g)	Units 6&7 Count	Length Range (mm)	Length Average (mm)	Weight Range (g)	Weight Average (g)
INVERTEBRATES (continued)											
Crangon nigromaculata	spotted bay shrimp	250	5-16	12.3	0.7-3.7	1.9	Not operating, therefore no sampling.				
Crangon spp.	bay shrimp	6	-	-	-	-					
Heptacarpus spp.	tidepool shrimps	12	6-12	8.4	<0.1-0.4	0.2					
Loligo opalescens	market squid	1	-	-	-	-					
Lophopanopeus bellus	black-claw crestleg crab	2	12-19	15.5	1.4-2.8	2.1					
Neotrypaea californiensis	ghost bay shrimp	1	17	17.0	0.1	0.1					
Pachycheles spp.	porcelain crabs	2	7-8	7.5	0.5-0.7	0.6					
Pachygrapsus crassipes	striped shore crab	18	11-34	15.7	0.3-8.5	2.2					
Pandalus danae	dock shrimp	2	45	45.0	6.8-7.0	6.9					
Penaeus californiensis	brown shrimp	1	48	48.0	42.0	42.0					
Pugettia producta	northern kelp crab	7	9-22	15.7	0.5-4.5	2.3					

*Totals for Units 1&2 include bar rack sample totals.

Table B-6. Moss Landing Power Plant Impingement Abundance Survey 06, December 14, 2005.

Taxon	Common Name	Units 1&2* Count	Length Range (mm)	Length Average (mm)	Weight Range (g)	Weight Average (g)	Units 6&7 Count	Length Range (mm)	Length Average (mm)	Weight Range (g)	Weight Average (g)
FISHES											
Acanthogobius flavimanus	yellowfin goby	1	118	118.0	19.7	19.7	Not operating, therefore no sampling.				
Artedius corallinus	coralline sculpin	2	73-93	83.0	6.8-18.4	12.6					
Artedius notospilotus	bonyhead sculpin	1	104	104.0	26.9	26.9					
Atherinops affinis	topsmelt	1	84	84.0	5.7	5.7					
Citharichthys spp.	sanddabs	2	-	-	-	-					
Citharichthys stigmaeus	speckled sanddab	1	36	36.0	0.6	0.6					
Clevelandia ios	arrow goby	9	42-54	49.5	0.5-2.0	1.3					
Gasterosteus aculeatus	threespine stickleback	3	29-32	31.0	0.1-0.3	0.2					
Heterostichus rostratus	giant kelpfish	1	51	51.0	7.2	7.2					
Lepidogobius lepidus	bay goby	1	73	73.0	4.0	4.0					
Leptocottus armatus	Pacific staghorn sculpin	2	48-158	103.0	1.1-63.3	32.2					
Porichthys notatus	plainfin midshipman	32	32-60	45.9	0.4-2.5	1.2					
Scorpaenichthys marmoratus	cabezon	1	190	190.0	186.5	186.5					
Symphurus atricauda	California tonguefish	2	86-110	98.0	6.2-10.9	8.5					
Syngnathus spp.	pipefishes	24	100-242	178.4	0.2-5.0	2.1					
Torpedo californica	Pacific electric ray	1	135	135.0	110.0	110.0					
INVERTEBRATES											
Cancer antennarius	brown rock crab	5	58-78	68.2	32.3-121.3	72.2					
Cancer gracilis	slender crab	3	37-42	39.3	10.0-14.2	11.4					
Cancer jordani	hairy rock crab	3	10-25	16.7	0.2-3.2	1.4					
Cancer productus	red rock crab	5	29-60	45.2	3.8-27.2	15.5					
Crangon franciscorum	Franciscan bay shrimp	1	10	10.0	0.8	0.8					
Crangon nigricauda	black-tailed bay shrimp	21	6-15	9.6	0.3-3.2	1.3					
Crangon nigromaculata	spotted bay shrimp	10	9-16	10.9	0.8-3.7	1.4					
Grapsidae unid.	shore crabs	1	11	11.0	0.5	0.5					
Heptacarpus spp.	tidepool shrimps	8	4-12	9.1	0.1-1.6	0.4					
Pachycheles rudis	thickclaw porcelain crab	1	8	8.0	0.8	0.8					
Pachygrapsus crassipes	striped shore crab	16	8-37	16.9	0.1-17.3	3.8					
Pugettia producta	northern kelp crab	8	12-26	17.4	1.4-8.3	3.1					

*Totals for Units 1&2 include bar rack sample totals.

Table B-7. Moss Landing Power Plant Impingement Abundance Survey 07, December 21, 2005.

Taxon	Common Name	Units 1&2* Count	Length Range (mm)	Length Average (mm)	Weight Range (g)	Weight Average (g)	Units 6&7 Count	Length Range (mm)	Length Average (mm)	Weight Range (g)	Weight Average (g)
FISHES											
Acanthogobius flavimanus	yellowfin goby	1	167	167.0	49.1	49.1	Not operating, therefore no sampling.				
Artedius notospilotus	bonyhead sculpin	2	90-93	91.5	16.6-20.6	18.6					
Atherinops affinis	topsmelt	25	55-133	91.5	1.1-12.3	6.4					
Citharichthys spp.	sanddabs	2	-	-	-	-					
Citharichthys stigmaeus	speckled sanddab	16	30-53	41.9	0.4-1.9	1.1					
Clevelandia ios	arrow goby	148	32-62	51.2	0.5-2.2	1.2					
Clupea pallasii	Pacific herring	1	178	178.0	40.4	40.4					
Gasterosteus aculeatus	threespine stickleback	10	26-47	34.3	0.1-1.3	0.6					
Gibbonsia metzi	striped kelpfish	1	63	63.0	2.3	2.3					
Lepidogobius lepidus	bay goby	6	73-87	82.0	4.0-6.4	5.2					
Leptocottus armatus	Pacific staghorn sculpin	1	62	62.0	4.0	4.0					
Neoclinus uninotatus	onespot fringehead	1	90	90.0	5.2	5.2					
Odontopyxis trispinosa	pygmy poacher	2	69-80	74.5	1.8-2.2	2.0					
Porichthys notatus	plainfin midshipman	212	36-69	48.1	0.5-6.7	1.4					
Rhinogobiops nicholsi	blackeye goby	1	46	46.0	1.6	1.6					
Sardinops sagax	Pacific sardine	1	149	149.0	35.0	35.0					
Symphurus atricauda	California tonguefish	13	79-99	91.5	4.4-9.5	6.7					
Syngnathus spp.	pipefishes	40	106-237	166.3	0.1-4.3	1.7					
INVERTEBRATES											
Blepharipoda occidentalis	spiny mole crab	1	26	26.0	6.3	6.3					
Cancer antennarius	brown rock crab	11	12-80	41.9	0.9-124.9	37.0					
Cancer productus	red rock crab	8	14-99	50.4	1.3-111.1	35.7					
Crangon franciscorum	Franciscan bay shrimp	315	5-19	13.1	0.3-4.9	1.9					
Crangon nigricauda	black-tailed bay shrimp	405	6-17	10.6	0.2-4.6	1.5					
Crangon nigromaculata	spotted bay shrimp	792	6-18	10.8	0.3-4.5	1.7					
Crangon spp.	bay shrimp	23	-	-	-	2.0					
Emerita analoga	mole crab	25	9-21	13.9	0.4-5.0	1.4					
Heptacarpus spp.	tidepool shrimps	51	3-11	6.1	0.1-1.6	0.5					
Octopus bimaculatus	California two-spot octopus	1	435	435.0	51.7	51.7					
Pachygrapsus crassipes	striped shore crab	5	12-21	16.0	1.1-7.2	3.7					
Pugettia producta	northern kelp crab	17	8-24	14.4	0.6-7.5	2.4					

*Totals for Units 1&2 include bar rack sample totals.

Table B-8. Moss Landing Power Plant Impingement Abundance Survey 08, December 28, 2005.

Taxon	Common Name	Units 1&2* Count	Length Range (mm)	Length Average (mm)	Weight Range (g)	Weight Average (g)	Units 6&7 Count	Length Range (mm)	Length Average (mm)	Weight Range (g)	Weight Average (g)
FISHES											
Artedius notospilotus	bonyhead sculpin	1	103	103.0	30.4	30.4	Not operating, therefore no sampling.				
Atherinops affinis	topsmelt	23	47-88	66.1	0.7-5.8	2.5					
Citharichthys stigmaeus	speckled sanddab	19	22-52	31.5	0.2-2.0	0.5					
Clevelandia ios	arrow goby	115	29-58	49.7	0.3-2.0	1.2					
Gasterosteus aculeatus	threespine stickleback	11	24-43	33.6	0.2-1.0	0.5					
Gibbonsia montereyensis	crevice kelpfish	1	55	55.0	1.6	1.6					
Gibbonsia spp.	clinid kelpfishes	1	57	57.0	1.8	1.8					
Lepidogobius lepidus	bay goby	8	80-87	83.3	4.9-7.2	6.2					
Leptocottus armatus	Pacific staghorn sculpin	2	67-155	111.0	5.2-44.1	24.6					
Parophrys vetulus	English sole	3	77-156	104.3	5.4-34.6	15.5					
Porichthys notatus	plainfin midshipman	62	31-57	44.7	0.4-2.0	1.1					
Rimicola muscarum	kelp clingfish	3	24-30	26.3	0.0-0.2	0.1					
Scorpaenichthys marmoratus	cabezon	2	139-213	176.0	60.6-260.7	160.7					
Symphurus atricauda	California tonguefish	4	85-93	89.3	4.9-7.7	6.1					
Syngnathus spp.	pipefishes	40	100-256	156.6	0.1-7.5	1.5					
INVERTEBRATES											
Blepharipoda occidentalis	spiny mole crab	3	25-29	27.7	6.9-11.7	10.1					
Callianassa californiensis	ghost shrimp	1	17	17.0	5.3	5.3					
Cancer antennarius	brown rock crab	16	10-97	33.1	0.4-211.0	23.3					
Cancer gracilis	slender crab	2	52-61	56.5	25.4-40.9	33.2					
Cancer jordani	hairy rock crab	10	12-28	17.6	0.7-5.5	1.9					
Cancer productus	red rock crab	13	23-78	44.1	2.0-69.4	18.4					
Cancer spp.	cancer crabs	1	11	11.0	0.3	0.3					
Crangon alaskensis	northern crangon	9	9-16	12.7	0.5-3.9	2.1					
Crangon franciscorum	Franciscan bay shrimp	139	10-19	14.8	0.9-5.3	2.7					
Crangon nigricauda	black-tailed bay shrimp	179	6-17	10.6	0.3-4.0	1.5					
Crangon nigromaculata	spotted bay shrimp	171	7-16	12.2	0.3-4.3	1.9					
Crangon spp.	bay shrimp	1	-	-	-	-					
Emerita analoga	mole crab	22	11-21	15.6	0.3-3.5	1.5					
Hemigrapsus oregonensis	yellow shore crab	10	14-21	18.5	1.1-4.9	2.8					
Heptacarpus spp.	tidepool shrimps	23	3-24	9.9	<0.1-2.2	0.4					
Pachygrapsus crassipes	striped shore crab	1	30	30.0	13.6	13.6					
Pandalus danae	dock shrimp	7	10-44	36.9	0.2-8.0	5.7					
Protothaca staminea	Pacific littleneck	3	7-36	26.0	0.3-22.8	12.2					
Pugettia producta	northern kelp crab	21	8-34	15.6	0.6-13.5	2.5					
Strongylocentrotus purpuratus	purple sea urchin	1	11	11.0	0.4	0.4					

*Totals for Units 1&2 include bar rack sample totals.

Table B-9. Moss Landing Power Plant Impingement Abundance Survey 09, January 4, 2006.

		Units 1&2*					Units 6&7				
			Length		Weight			Length		Weight	
Taxon	Common Name	Count	Range (mm)	Average	Range (g)	Average	Count	Range (mm)	Average	Range (g)	Average
FISHES											
Acipenser mediros	green sturgeon	1	546	546.0	750.0	750.0	Not operating, therefore no sampling.				
Artedius corallinus	coralline sculpin	1	76	76.0	9.4	9.4					
Artedius harringtoni	scalyhead sculpin	1	77	77.0	10.2	10.2					
Artedius notospilotus	bonyhead sculpin	1	71	71.0	8.6	8.6					
Atherinops affinis	topsmelt	2,069	47-131	82.7	0.6-24.2	5.4					
Cebidichthys violaceus	monkeyface eel	2	125-324	224.5	11.3-236.4	123.8					
Chilara taylori	spotted cusk-eel	2	70-222	146.0	0.4-54.7	27.6					
Citharichthys spp.	sanddabs	273	24-61	33.0	0.1-4.1	0.6					
Citharichthys stigmaeus	speckled sanddab	45	29-76	42.0	0.2-7.4	1.3					
Clevelandia ios	arrow goby	135	31-57	46.3	0.2-1.6	0.9					
Cymatogaster aggregata	shiner surfperch	1	49	49.0	3.2	3.2					
Engraulis mordax	northern anchovy	19	60-138	80.9	1.6-18.0	4.4					
Gasterosteus aculeatus	threespine stickleback	62	19-52	33.6	0.1-1.6	0.5					
Gibbonsia metzi	striped kelpfish	1	87	87.0	7.7	7.7					
Gobiidae unid.	gobies	3	22-33	26.0	0.1	0.1					
Lepidogobius lepidus	bay goby	15	61-90	80.1	1.9-8.4	5.7					
Leptocottus armatus	Pacific staghorn sculpin	2	73-110	91.5	6.3-24.1	15.2					
Odontopyxis trispinosa	pygmy poacher	1	85	85.0	3.2	3.2					
Parophrys vetulus	English sole	5	35-155	98.0	0.7-34.6	14.7					
Porichthys notatus	plainfin midshipman	221	35-68	44.9	0.4-4.1	1.1					
Rhinogobiops nicholsi	blackeye goby	4	25-38	31.8	0.1-0.9	0.5					
Rimicola muscarum	kelp clingfish	4	31-36	33.5	0.1-0.3	0.2					
Rimicola spp.	kelp clingfishes	1	24	24.0	0.1	0.1					
Ruscarius creaseri	roughcheek sculpin	1	44	44.0	1.9	1.9					
Sardinops sagax	Pacific sardine	1	172	172.0	51.4	51.4					
Symphurus atricauda	California tonguefish	14	72-102	87.3	3.5-10.7	6.8					
Syngnathus spp.	pipefishes	65	69-235	163.3	0.1-4.5	1.3					
INVERTEBRATES											
Blepharipoda occidentalis	spiny mole crab	6	18-27	22.0	2.6-9.8	5.9					
Cancer antennarius	brown rock crab	5	22-82	40.2	1.7-55.6	18.1					
Cancer anthonyi	yellow crab	3	21-45	34.0	1.8-19.1	9.5					
Cancer gracilis	slender crab	1	70	70.0	41.9	41.9					

*Totals for Units 1&2 include bar rack sample totals.

(continued)

Table B-9 continued. Moss Landing Power Plant Impingement Abundance Survey 09, January 4, 2006.

Taxon	Common Name	Units 1&2* Count	Units 1&2* Length Range (mm)	Units 1&2* Length Average (mm)	Units 1&2* Weight Range (g)	Units 1&2* Weight Average (g)	Units 6&7 Count	Units 6&7 Length Range (mm)	Units 6&7 Length Average (mm)	Units 6&7 Weight Range (g)	Units 6&7 Weight Average (g)
INVERTEBRATES (continued)											
Cancer jordani	hairy rock crab	4	15-23	19.3	1.0-3.9	2.3	Not operating, therefore no sampling.				
Cancer productus	red rock crab	11	29-70	52.1	5.6-93.0	33.4					
Cancer spp.	cancer crabs	4	8-14	11.3	0.2-0.6	0.4					
Crangon alaskensis	northern crangon	32	6-20	10.8	0.4-3.3	2.1					
Crangon franciscorum	Franciscan bay shrimp	616	9-19	13.5	0.5-4.6	2.3					
Crangon nigricauda	black-tailed bay shrimp	145	9-16	13.2	0.4-3.8	1.8					
Crangon nigromaculata	spotted bay shrimp	3,104	6-15	10.0	0.3-7.0	0.9					
Crangon spp.	bay shrimp	2,724	5-16	9.8	0.2-3.5	0.8					
Emerita analoga	mole crab	14	11-31	18.1	0.5-11.5	2.7					
Heptacarpus spp.	tidepool shrimps	161	5-15	9.0	0.1-1.8	0.5					
Lophopanopeus bellus	black-claw crestleg crab	1	12	12.0	0.9	0.9					
Lophopanopeus spp.	black-clawed crabs	1	9	9.0	1.1	1.1					
Neotrypaea californiensis	ghost bay shrimp	6	7-20	13.8	1.1-8.6	3.4					
Octopus bimaculatus	California two-spot octopus	5	303-540	397.2	28.3-290.8	118.7					
Pachygrapsus crassipes	striped shore crab	2	17-18	17.5	2.1-45.0	23.5					
Pandalus danae	dock shrimp	2	42-45	43.5	8.3-8.8	8.6					
Pugettia producta	northern kelp crab	25	6-36	17.8	0.5-26.2	4.6					

*Totals for Units 1&2 include bar rack sample totals.

Table B-10. Moss Landing Power Plant Impingement Abundance Survey 10, January 11, 2006.

		Units 1&2*					Units 6&7				
			Length		Weight			Length		Weight	
Taxon	Common Name	Count	Range (mm)	Average	Range (g)	Average	Count	Range (mm)	Average	Range (g)	Average
FISHES											
Artedius lateralis	smoothhead sculpin	1	86	86.0	13.4	13.4	Not operating, therefore no sampling.				
Atherinops affinis	topsmelt	40	41-111	70.5	0.8-12.3	3.2					
Citharichthys spp.	sanddabs	2	32	32.0	0.2-0.6	0.4					
Citharichthys stigmaeus	speckled sanddab	5	31-62	49.2	0.4-3.5	2.0					
Clevelandia ios	arrow goby	38	32-60	46.9	0.2-1.6	0.9					
Cymatogaster aggregata	shiner surfperch	1	63	63.0	5.4	5.4					
Gasterosteus aculeatus	threespine stickleback	9	25-37	30.7	0.1-0.5	0.3					
Gobiidae unid.	gobies	2	27-30	28.5	0.1-0.2	0.2					
Lepidogobius lepidus	bay goby	4	68-86	78.5	2.3-5.3	4.2					
Porichthys notatus	plainfin midshipman	20	31-62	44.2	0.4-2.8	1.1					
Sebastes auriculatus	brown rockfish	1	33	33.0	0.7	0.7					
Symphurus atricauda	California tonguefish	3	63-97	80.0	2.4-8.8	5.6					
Syngnathus spp.	pipefishes	32	76-261	166.1	0.1-5.6	1.5					
unidentified fish, damaged	unidentified damaged fish	1	-	-	-	-					
INVERTEBRATES											
Cancer antennarius	brown rock crab	7	34-100	57.7	7.7-170.7	47.3					
Cancer gracilis	slender crab	1	17	17.0	1.5	1.5					
Cancer jordani	hairy rock crab	1	16	16.0	1.5	1.5					
Cancer productus	red rock crab	16	11-86	47.6	0.3-68.3	27.0					
Cancer spp.	cancer crabs	1	6	6.0	0.1	0.1					
Crangon franciscorum	Franciscan bay shrimp	1	13	13.0	2.9	2.9					
Crangon nigricauda	black-tailed bay shrimp	8	7-13	9.4	0.4-2.7	1.0					
Crangon nigromaculata	spotted bay shrimp	16	7-13	9.4	0.4-2.2	0.9					
Crangon spp.	bay shrimp	38	7-18	11.8	0.4-4.7	1.6					
Emerita analoga	mole crab	3	17-19	18.0	1.5-1.8	1.7					
Hemigrapsus oregonensis	yellow shore crab	1	12	12.0	1.0	1.0					
Heptacarpus spp.	tidepool shrimps	27	2-24	8.6	0.1-2.1	0.4					
Pachygrapsus crassipes	striped shore crab	7	12-28	18.7	0.9-9.3	4.5					
Pandalus danae	dock shrimp	1	42	42.0	7.0	7.0					
Protothaca staminea	Pacific littleneck	1	12	12.0	0.9	0.9					
Pugettia producta	northern kelp crab	6	10-31	15.2	0.8-18.7	4.3					
Scyra acutifrons	sharp-nosed crab	1	9	9.0	0.7	0.7					

*Totals for Units 1&2 include bar rack sample totals.

Table B-11. Moss Landing Power Plant Impingement Abundance Survey 11, January 19, 2006.

Taxon	Common Name	Units 1&2* Count	Units 1&2* Length Range (mm)	Units 1&2* Length Average (mm)	Units 1&2* Weight Range (g)	Units 1&2* Weight Average (g)	Units 6&7 Count	Units 6&7 Length Range (mm)	Units 6&7 Length Average (mm)	Units 6&7 Weight Range (g)	Units 6&7 Weight Average (g)
FISHES											
Atherinops affinis	topsmelt	26	53-107	71.9	1.1-12.0	3.3	Not operating, therefore no sampling.				
Atherinopsidae unid.	silversides	1	-	-	-	-					
Citharichthys spp.	sanddabs	142	27-76	44.5	0.1-6.7	1.3					
Citharichthys stigmaeus	speckled sanddab	15	25-126	40.3	0.1-25.7	2.2					
Clevelandia ios	arrow goby	60	38-59	48.4	0.4-2.7	1.1					
Cymatogaster aggregata	shiner surfperch	1	76	76.0	9.6	9.6					
Engraulis mordax	northern anchovy	41	64-106	85.0	1.7-7.9	3.9					
Gasterosteus aculeatus	threespine stickleback	5	31-36	32.8	0.3-0.6	0.4					
Gobiidae unid.	gobies	5	27-34	30.8	0.1-0.4	0.2					
Lepidogobius lepidus	bay goby	20	28-91	55.3	0.1-8.4	3.0					
Leptocottus armatus	Pacific staghorn sculpin	2	55-93	74.0	2.4-13.0	7.7					
Parophrys vetulus	English sole	1	140	140.0	31.4	31.4					
Phanerodon furcatus	white surfperch	1	154	154.0	72.7	72.7					
Porichthys notatus	plainfin midshipman	87	30-63	48.3	0.3-3.5	1.4					
Symphurus atricauda	California tonguefish	2	96	96.0	6.5	6.5					
Syngnathus spp.	pipefishes	55	94-282	162.1	0.1-4.7	1.3					
INVERTEBRATES											
Cancer antennarius	brown rock crab	3	65-71	67.7	58.3-84.4	68.9					
Cancer anthonyi	yellow crab	1	80	80.0	71.5	71.5					
Cancer jordani	hairy rock crab	8	7-23	16.8	0.7-4.1	1.7					
Cancer productus	red rock crab	10	40-92	53.7	10.0-91.5	25.6					
Crangon franciscorum	Franciscan bay shrimp	1	14	14.0	2.1	2.1					
Crangon nigricauda	black-tailed bay shrimp	2	8-12	10.0	0.6-0.7	0.7					
Crangon nigromaculata	spotted bay shrimp	14	5-11	7.6	0.1-1.3	0.5					
Crangon spp.	bay shrimp	1,290	6-19	11.2	0.2-4.7	1.0					
Emerita analoga	mole crab	1	13	13.0	0.8	0.8					
Hemigrapsus oregonensis	yellow shore crab	1	13	13.0	0.7	0.7					
Heptacarpus spp.	tidepool shrimps	36	6-18	9.6	0.1-1.2	0.5					
Loligo opalescens	market squid	1	260	260.0	37.4	37.4					
Neotrypaea californiensis	ghost bay shrimp	1	14	14.0	2.2	2.2					
Pachycheles spp.	porcelain crabs	1	9	9.0	0.5	0.5					
Pachygrapsus crassipes	striped shore crab	2	19-25	22.0	2.8-6.7	4.7					
Penaeus californiensis	brown shrimp	1	54	54.0	37.6	37.6					
Pugettia producta	northern kelp crab	11	8-51	17.1	0.1-71.3	7.9					

*Totals for Units 1&2 include bar rack sample totals.

Table B-12. Moss Landing Power Plant Impingement Abundance Survey12, January 25, 2006.

		Units 1&2*					Units 6&7				
			Length		Weight			Length		Weight	
Taxon	Common Name	Count	Range (mm)	Average	Range (g)	Average	Count	Range (mm)	Average	Range (g)	Average
FISHES											
Artedius notospilotus	bonyhead sculpin	1	49	49.0	2.8	2.8	Not operating, therefore no sampling.				
Atherinops affinis	topsmelt	18	50-126	79.1	0.8-20.7	5.3					
Atherinopsidae unid.	silversides	3	47	47.0	0.5	0.5					
Aulorhynchus flavidus	tubesnout	1	131	131.0	2.7	2.7					
Citharichthys stigmaeus	speckled sanddab	3	33-40	35.7	0.2-0.8	0.4					
Clevelandia ios	arrow goby	14	43-55	49.2	0.7-1.7	1.0					
Engraulis mordax	northern anchovy	140	58-108	81.8	1.2-7.4	3.4					
Gasterosteus aculeatus	threespine stickleback	10	24-38	31.0	0.1-0.8	0.4					
Gobiidae unid.	gobies	2	21	21.0	0.1	0.1					
Lepidogobius lepidus	bay goby	3	75-87	81.3	5.4-6.4	5.8					
Platichthys stellatus	starry flounder	1	167	167.0	93.9	93.9					
Porichthys notatus	plainfin midshipman	5	42-61	50.0	0.8-2.8	1.5					
Rhinogobiops nicholsi	blackeye goby	1	51	51.0	2.0	2.0					
Scorpaenichthys marmoratus	cabezon	2	31-59	45.0	0.7-4.3	2.5					
Syngnathus spp.	pipefishes	18	73-269	162.5	0.1-5.8	1.4					
INVERTEBRATES											
Cancer antennarius	brown rock crab	3	23-71	53.3	4.2-76.4	46.2					
Cancer gracilis	slender crab	2	35-62	48.5	8.8-48.4	28.6					
Cancer jordani	hairy rock crab	3	9-22	16.7	0.1-3.2	1.4					
Cancer productus	red rock crab	2	30-57	43.5	5.3-21.8	13.5					
Cancer spp.	cancer crabs	1	11	11.0	0.6	0.6					
Crangon nigricauda	black-tailed bay shrimp	2	9-11	10.0	0.9-2.7	1.8					
Crangon spp.	bay shrimp	1	-	-	-	-					
Hemigrapsus oregonensis	yellow shore crab	1	10	10.0	0.7	0.7					
Heptacarpus spp.	tidepool shrimps	4	6-10	8.3	0.2-1.7	1.0					
Loligo opalescens	market squid	3	67-116	99.3	1.6-6.8	4.6					
Pachygrapsus crassipes	striped shore crab	3	13-19	15.7	0.8-4.4	2.3					
Pugettia producta	northern kelp crab	15	10-34	17.1	0.9-22.0	4.4					

*Totals for Units 1&2 include bar rack sample totals.

Table B-13. Moss Landing Power Plant Impingement Abundance Survey 13, February 1, 2006.

		Units 1&2*					Units 6&7				
			Length		Weight			Length		Weight	
Taxon	Common Name	Count	Range (mm)	Average	Range (g)	Average	Count	Range (mm)	Average	Range (g)	Average
FISHES											
Artedius harringtoni	scalyhead sculpin	1	68	68.0	8.3	8.3	Not operating, therefore no sampling.				
Citharichthys spp.	sanddabs	13	27-34	30.3	0.2-0.4	0.3					
Citharichthys stigmaeus	speckled sanddab	14	30-46	33.9	0.2-1.3	0.5					
Clevelandia ios	arrow goby	7	37-54	44.0	0.6-2.0	1.0					
Engraulis mordax	northern anchovy	20	73-103	84.5	2.7-7.9	4.1					
Gasterosteus aculeatus	threespine stickleback	1	22	22.0	0.1	0.1					
Porichthys notatus	plainfin midshipman	5	42-56	49.0	1.0-2.2	1.5					
Symphurus atricauda	California tonguefish	2	86-93	89.5	6.7-8.2	7.4					
Syngnathus spp.	pipefishes	9	128-207	154.8	0.5-3.2	1.2					
Artedius harringtoni	scalyhead sculpin	1	68	68.0	8.3	8.3					
Citharichthys spp.	sanddabs	13	27-34	30.3	0.2-0.4	0.3					
INVERTEBRATES											
Blepharipoda occidentalis	spiny mole crab	1	25	25.0	7.1	7.1					
Cancer antennarius	brown rock crab	3	30-51	38.3	8.2-35.7	17.8					
Cancer jordani	hairy rock crab	1	16	16.0	1.3	1.3					
Cancer productus	red rock crab	5	40-87	61.6	10.6-63.8	36.8					
Cancer spp.	cancer crabs	5	8-11	9.8	0.1-0.4	0.3					
Crangon franciscorum	Franciscan bay shrimp	1	14	14.0	2.1	2.1					
Crangon nigricauda	black-tailed bay shrimp	1	10	10.0	1.6	1.6					
Crangon nigromaculata	spotted bay shrimp	5	6-14	10.4	0.1-2.8	1.3					
Crangon spp.	bay shrimp	2	9	9.0	0.7	0.7					
Emerita analoga	mole crab	1	15	15.0	0.9	0.9					
Hemigrapsus oregonensis	yellow shore crab	1	16	16.0	2.4	2.4					
Heptacarpus spp.	tidepool shrimps	12	4-14	7.2	0.1-1.5	0.5					
Neotrypaea californiensis	ghost bay shrimp	1	12	12.0	1.9	1.9					
Pachygrapsus crassipes	striped shore crab	5	9-10	9.7	0.4-0.6	0.5					
Pugettia producta	northern kelp crab	6	14-20	16.0	2.1-6.6	3.1					

*Totals for Units 1&2 include bar rack sample totals.

Table B-14. Moss Landing Power Plant Impingement Abundance Survey 14, February 7, 2006.

		Units 1&2*					Units 6&7				
			Length		Weight			Length		Weight	
Taxon	Common Name	Count	Range (mm)	Average	Range (g)	Average	Count	Range (mm)	Average	Range (g)	Average
FISHES											
Atherinops affinis	topsmelt	3	53-73	62.0	0.9-3.0	1.9	Not operating, therefore no sampling.				
Citharichthys stigmaeus	speckled sanddab	2	32-33	32.5	0.4	0.4					
Clevelandia ios	arrow goby	3	51-58	54.7	0.8-2.1	1.4					
Engraulis mordax	northern anchovy	175	61-100	83.5	1.6-7.5	3.8					
Gasterosteus aculeatus	threespine stickleback	5	35-50	42.4	0.5-1.5	1.1					
Lepidogobius lepidus	bay goby	4	31-36	32.5	0.2-0.5	0.3					
Porichthys notatus	plainfin midshipman	2	37-49	43.0	0.6-1.3	0.9					
Symphurus atricauda	California tonguefish	1	91	91.0	6.1	6.1					
Syngnathus spp.	pipefishes	7	110-209	143.1	0.3-2.7	1.1					
INVERTEBRATES											
Cancer antennarius	brown rock crab	2	47-49	48.0	24.4-32.7	28.6					
Cancer jordani	hairy rock crab	5	9-17	12.6	0.2-1.4	0.7					
Cancer productus	red rock crab	4	6-39	26.5	0.1-10.3	5.5					
Cancer spp.	cancer crabs	1	6	6.0	0.2	0.2					
Crangon nigricauda	black-tailed bay shrimp	1	10	10.0	2.0	2.0					
Crangon nigromaculata	spotted bay shrimp	1	11	11.0	2.5	2.5					
Emerita analoga	mole crab	2	2.2-15	8.6	1.4-1.7	1.6					
Hemigrapsus nudus	purple shore crab	1	37	37.0	24.7	24.7					
Hemigrapsus oregonensis	yellow shore crab	2	13-18	15.5	2.0-4.2	3.1					
Heptacarpus spp.	tidepool shrimps	2	19-21	20.0	0.3-0.4	0.4					
Loligo opalescens	market squid	1	115	115.0	11.7	11.7					
Macoma spp.	clam	3	23-26	24.5	2.5-4.0	3.3					
Pachygrapsus crassipes	striped shore crab	8	6-28	15.9	0.3-11.6	3.1					
Protothaca spp.	unidentified littleneck clam	1	12	12.0	0.4	0.4					
Pugettia producta	northern kelp crab	5	9-23	15.8	0.9-5.2	3.0					
Upogebia pugettensis	blue mud shrimp	1	10	10.0	1.3	1.3					

*Totals for Units 1&2 include bar rack sample totals.

Table B-15. Moss Landing Power Plant Impingement Abundance Survey 15, February 15, 2006.

		Units 1&2*					Units 6&7				
			Length		Weight			Length		Weight	
Taxon	Common Name	Count	Range (mm)	Average	Range (g)	Average	Count	Range (mm)	Average	Range (g)	Average
FISHES											
Acanthogobius flavimanus	yellowfin goby	2	152-153	152.5	37.2-39.4	38.3	Not operating, therefore no sampling.				
Apodichthys flavidus	penpoint gunnel	1	116	116.0	6.3	6.3					
Artedius lateralis	smoothhead sculpin	1	80	80.0	10.1	10.1					
Atherinops affinis	topsmelt	3	61-77	71.3	1.8-3.8	3.1					
Citharichthys spp.	sanddabs	6	28-43	35.0	0.3-1.1	0.7					
Citharichthys stigmaeus	speckled sanddab	19	33-79	49.9	0.5-7.3	2.2					
Clevelandia ios	arrow goby	8	46-55	50.8	0.9-1.6	1.4					
Engraulis mordax	northern anchovy	85	61-110	83.9	1.8-8.5	3.8					
Gasterosteus aculeatus	threespine stickleback	7	33-47	37.6	0.4-1.0	0.7					
Gobiidae unid.	gobies	1	34	34.0	0.3	0.3					
Leptocottus armatus	Pacific staghorn sculpin	1	73	73.0	6.2	6.2					
Porichthys notatus	plainfin midshipman	4	36-52	45.0	0.6-1.7	1.1					
Rhinogobiops nicholsi	blackeye goby	3	60-61	60.7	3.5-3.7	3.6					
Sardinops sagax	Pacific sardine	1	94	94.0	6.1	6.1					
Scorpaenichthys marmoratus	cabezon	2	34-35	34.5	1.1-1.2	1.2					
Syngnathus spp.	pipefishes	41	93-254	164.6	0.1-4.5	1.4					
INVERTEBRATES											
Cancer antennarius	brown rock crab	5	34-104	61.8	11.8-294.4	87.6					
Cancer jordani	hairy rock crab	9	14-17	15.4	0.7-1.8	1.1					
Cancer productus	red rock crab	2	51	51.0	17.7	17.7					
Cancer spp.	cancer crabs	2	9-14	11.5	0.1-0.9	0.5					
Crangon nigricauda	black-tailed bay shrimp	1	13	13.0	2.3	2.3					
Crangon nigromaculata	spotted bay shrimp	22	8-15	10.3	0.5-3.4	1.3					
Crangon spp.	bay shrimp	21	7-14	10.2	0.2-3.3	1.4					
Hemigrapsus oregonensis	yellow shore crab	1	19	19.0	4.3	4.3					
Heptacarpus spp.	tidepool shrimps	16	6-11	8.4	0.1-2.2	0.8					
Neotrypaea californiensis	ghost bay shrimp	1	13	13.0	2.7	2.7					
Pachygrapsus crassipes	striped shore crab	3	12-16	13.7	0.8-2.0	1.4					
Pugettia producta	northern kelp crab	35	12-46	21.2	1.1-38.9	5.9					

*Totals for Units 1&2 include bar rack sample totals.

Table B-16. Moss Landing Power Plant Impingement Abundance Survey 16, February 22, 2006.

Taxon	Common Name	Units 1&2* Count	Length Range (mm)	Length Average (mm)	Weight Range (g)	Weight Average (g)	Units 6&7 Count	Length Range (mm)	Length Average (mm)	Weight Range (g)	Weight Average (g)
FISHES											
Ammodytes hexapterus	Pacific sand lance	1	108	108.0	3.8	3.8	Not operating, therefore no sampling.				
Artedius harringtoni	scalyhead sculpin	1	88	88.0	20.3	20.3					
Artedius lateralis	smoothhead sculpin	1	97	97.0	21.8	21.8					
Atherinops affinis	topsmelt	1	113	113.0	10.2	10.2					
Citharichthys spp.	sanddabs	1	36	36.0	0.6	0.6					
Citharichthys stigmaeus	speckled sanddab	2	72-77	74.5	5.6-6.3	6.0					
Clevelandia ios	arrow goby	1	40	40.0	0.6	0.6					
Engraulis mordax	northern anchovy	39	72-101	82.4	2.3-7.1	3.6					
Gasterosteus aculeatus	threespine stickleback	4	29-35	32.8	0.3-0.6	0.5					
Lepidogobius lepidus	bay goby	1	76	76.0	4.8	4.8					
Leptocottus armatus	Pacific staghorn sculpin	1	88	88.0	12.0	12.0					
Neoclinus uninotatus	onespot fringehead	1	108	108.0	10.5	10.5					
Phanerodon furcatus	white surfperch	1	103	103.0	22.5	22.5					
Porichthys notatus	plainfin midshipman	3	49-58	53.7	1.3-2.2	1.7					
Rhinogobiops nicholsi	blackeye goby	1	55	55.0	3.2	3.2					
Sardinops sagax	Pacific sardine	1	102	102.0	7.6	7.6					
Scorpaenichthys marmoratus	cabezon	2	31-49	40.0	0.9-2.4	1.7					
Symphurus atricauda	California tonguefish	1	88	88.0	5.7	5.7					
Syngnathus spp.	pipefishes	9	109-202	151.7	0.3-2.7	1.0					
unidentified fish, damaged	unidentified damaged fish	1	-	-	-	-					
INVERTEBRATES											
Cancer antennarius	brown rock crab	6	34-68	55.2	9.0-80.4	46.6					
Cancer gracilis	slender crab	1	83	83.0	118.1	118.1					
Cancer jordani	hairy rock crab	2	14-15	14.5	0.9	0.9					
Cancer productus	red rock crab	5	40-63	49.8	10.2-36.7	18.6					
Cancer spp.	cancer crabs	10	7-17	12.8	0.2-1.4	0.8					
Crangon nigricauda	black-tailed bay shrimp	1	13	13.0	3.8	3.8					
Crangon nigromaculata	spotted bay shrimp	4	11-16	13.3	1.3-4.1	2.4					
Crangon spp.	bay shrimp	1	9	9.0	0.8	0.8					
Hemigrapsus oregonensis	yellow shore crab	1	17	17.0	2.5	2.5					
Heptacarpus spp.	tidepool shrimps	3	8-10	9.3	0.2-0.9	0.5					
Neotrypaea californiensis	ghost bay shrimp	2	12-13	12.5	2.0-3.1	2.5					
Pachygrapsus crassipes	striped shore crab	2	16-22	19.0	1.9-4.3	3.1					
Pugettia producta	northern kelp crab	7	13-22	18.7	1.1-4.9	3.4					

*Totals for Units 1&2 include bar rack sample totals.

Table B-17. Moss Landing Power Plant Impingement Abundance Survey 17, March 1, 2006.

		Units 1&2*					Units 6&7				
			Length		Weight			Length		Weight	
Taxon	Common Name	Count	Range (mm)	Average	Range (g)	Average	Count	Range (mm)	Average	Range (g)	Average
FISHES											
Acanthogobius flavimanus	yellowfin goby	3	51-79	62.3	1.2-4.8	2.6	Not operating, therefore no sampling.				
Artedius notospilotus	bonyhead sculpin	1	88	88.0	16.0	16.0					
Chilara taylori	spotted cusk-eel	1	98	98.0	2.6	2.6					
Citharichthys stigmaeus	speckled sanddab	50	24-172	47.6	0.1-6.3	0.8					
Clevelandia ios	arrow goby	19	33-55	47.5	0.3-1.4	0.9					
Engraulis mordax	northern anchovy	11	62-95	81.3	1.7-5.8	3.2					
Gasterosteus aculeatus	threespine stickleback	1	53	53.0	2.2	2.2					
Lepidogobius lepidus	bay goby	8	56-90	67.4	1.5-5.8	2.9					
Leptocottus armatus	Pacific staghorn sculpin	6	33-172	86.2	0.5-24.5	7.5					
Platichthys stellatus	starry flounder	1	32	32.0	1.1	1.1					
Porichthys notatus	plainfin midshipman	4	37-60	48.0	0.5-1.6	1.1					
Scorpaenichthys marmoratus	cabezon	5	32-49	37.2	0.9-2.7	1.4					
Syngnathus spp.	pipefishes	13	125-229	176.5	0.2-3.7	1.6					
INVERTEBRATES											
Blepharipoda occidentalis	spiny mole crab	4	15-30	19.5	2.3-8.6	4.0					
Cancer antennarius	brown rock crab	1	63	63.0	59.1	59.1					
Cancer jordani	hairy rock crab	9	8-17	11.8	0.2-1.9	0.9					
Cancer productus	red rock crab	3	20-64	37.3	1.9-46.7	17.4					
Cancer spp.	cancer crabs	1	13	13.0	0.6	0.6					
Crangon franciscorum	Franciscan bay shrimp	2	7-11	9.0	0.8-1.8	1.3					
Crangon nigricauda	black-tailed bay shrimp	1	7	7.0	0.7	0.7					
Crangon nigromaculata	spotted bay shrimp	30	4-14	8.1	0.3-3.4	1.1					
Crangon spp.	bay shrimp	300	5-13	9.1	0.1-3.7	1.2					
Emerita analoga	mole crab	1	16	16.0	2.4	2.4					
Hemigrapsus oregonensis	yellow shore crab	2	13-19	16.0	1.0-4.2	2.6					
Heptacarpus spp.	tidepool shrimps	14	3-11	7.4	0.1-2.4	0.7					
Lophopanopeus spp.	black-clawed crabs	1	13	13.0	1.5	1.5					
Macoma spp.	clam	1	21	21.0	1.3	1.3					
Pachygrapsus crassipes	striped shore crab	5	13-32	20.0	1.3-19.0	7.0					
Pandalus danae	dock shrimp	1	15	15.0	3.0	3.0					
Pugettia producta	northern kelp crab	15	10-33	20.7	0.8-13.4	5.1					
Upogebia pugettensis	blue mud shrimp	2	11-15	13.0	2.9-5.1	4.0					

*Totals for Units 1&2 include bar rack sample totals.

Table B-18. Moss Landing Power Plant Impingement Abundance Survey 18, March 8, 2006.

Taxon	Common Name	Units 1&2* Count	Length Range (mm)	Length Average (mm)	Weight Range (g)	Weight Average (g)	Units 6&7
FISHES							
Acanthogobius flavimanus	yellowfin goby	1	175	175.0	51.6	51.6	Not operating, therefore no sampling.
Atherinopsidae unid.	silversides	1	-	-	-	-	
Citharichthys spp.	sanddabs	2	27-32	29.5	0.1	0.1	
Citharichthys stigmaeus	speckled sanddab	1	49	49.0	1.5	1.5	
Clevelandia ios	arrow goby	1	44	44.0	0.7	0.7	
Engraulis mordax	northern anchovy	3	57-79	68.0	1.5-3.3	2.4	
Gasterosteus aculeatus	threespine stickleback	1	48	48.0	2.0	2.0	
Pimephalas promelas	fathead minnow	1	36	36.0	0.8	0.8	
Symphurus atricauda	California tonguefish	1	83	83.0	4.9	4.9	
Syngnathus spp.	pipefishes	25	126-217	168.2	0.2-3.4	1.4	
INVERTEBRATES							
Cancer antennarius	brown rock crab	8	37-75	51.8	11.9-82.5	36.9	
Cancer gracilis	slender crab	1	59	59.0	23.5	23.5	
Cancer jordani	hairy rock crab	23	11-22	15.8	0.4-3.1	1.3	
Cancer productus	red rock crab	5	22-50	33.8	1.6-21.2	8.4	
Crangon franciscorum	Franciscan bay shrimp	1	14	14.0	2.0	2.0	
Crangon nigromaculata	spotted bay shrimp	4	7-14	10.0	0.2-2.5	1.0	
Crangon spp.	bay shrimp	3	8-14	10.0	0.5-3.1	1.4	
Emerita analoga	mole crab	3	13-18	15.0	0.6-1.8	1.1	
Heptacarpus spp.	tidepool shrimps	4	6-12	8.8	0.2-0.7	0.4	
Pachycheles rudis	thickclaw porcelain crab	1	9	9.0	1.4	1.4	
Pachygrapsus crassipes	striped shore crab	4	16-27	20.0	1.7-9.2	4.0	
Pelia tumida	dwarf teardrop crab	1	7	7.0	0.1	0.1	
Pugettia producta	northern kelp crab	6	20-41	26.0	3.6-24.6	8.7	

*Totals for Units 1&2 include bar rack sample totals.

Table B-19. Moss Landing Power Plant Impingement Abundance Survey 19, March 15, 2006.

		Units 1&2*					Units 6&7				
			Length		Weight			Length		Weight	
Taxon	Common Name	Count	Range (mm)	Average	Range (g)	Average	Count	Range (mm)	Average	Range (g)	Average
FISHES											
Citharichthys spp.	sanddabs	1	32	32.0	0.3	0.3	Not operating, therefore no sampling.				
Citharichthys stigmaeus	speckled sanddab	2	32-45	38.5	0.4-1.0	0.7					
Clevelandia ios	arrow goby	1	37	37.0	0.3	0.3					
Scorpaenichthys marmoratus	cabezon	2	37-42	39.5	1.1-1.5	1.3					
Sebastes auriculatus	brown rockfish	1	102	102.0	31.2	31.2					
Syngnathus spp.	pipefishes	5	131-219	180.0	0.3-5.5	2.1					
INVERTEBRATES											
Blepharipoda occidentalis	spiny mole crab	2	19-29	24.0	3.1-11.3	7.2					
Cancer antennarius	brown rock crab	2	68-72	70.0	60.3-70.4	65.4					
Cancer gracilis	slender crab	1	69	69.0	55.2	55.2					
Cancer jordani	hairy rock crab	15	9-21	16.8	0.1-2.4	1.4					
Cancer productus	red rock crab	2	45-55	50.0	13.1-23.5	18.3					
Caridean unid.	unidentified shrimp	1	-	-	-	-					
Crangon nigricauda	black-tailed bay shrimp	7	8-14	10.9	0.6-3.1	1.7					
Crangon nigromaculata	spotted bay shrimp	6	6-12	8.7	0.2-2.0	0.9					
Emerita analoga	mole crab	1	17	17.0	1.3	1.3					
Hemigrapsus oregonensis	yellow shore crab	1	13	13.0	1.3	1.3					
Heptacarpus spp.	tidepool shrimps	15	4-12	10.1	0.1-0.7	0.4					
Pachygrapsus crassipes	striped shore crab	4	15-28	22.5	1.1-13.6	7.0					
Pelia tumida	dwarf teardrop crab	1	10	10.0	0.2	0.2					
Pugettia producta	northern kelp crab	7	14-25	19.3	1.6-7.4	3.9					

*Totals for Units 1&2 include bar rack sample totals.

Table B-20. Moss Landing Power Plant Impingement Abundance Survey 20, March 22, 2006.

Taxon	Common Name	Units 1&2* Count	Length Range (mm)	Length Average (mm)	Weight Range (g)	Weight Average (g)	Units 6&7 Count	Length Range (mm)	Length Average (mm)	Weight Range (g)	Weight Average (g)
FISHES											
Artedius harringtoni	scalyhead sculpin	1	63	63.0	6.1	6.1	Not operating, therefore no sampling.				
Atherinops affinis	topsmelt	7	68-90	75.8	2.4-6.2	3.6					
Cebidichthys violaceus	monkeyface eel	1	262	262.0	105.1	105.1					
Citharichthys stigmaeus	speckled sanddab	10	32-77	57.4	0.3-6.7	3.0					
Clevelandia ios	arrow goby	3	40-88	66.3	0.6-6.8	3.6					
Cottus asper	prickly sculpin	2	83-85	84.0	9.9-12.3	11.1					
Engraulis mordax	northern anchovy	16	54-112	85.0	1.5-10.2	4.8					
Gasterosteus aculeatus	threespine stickleback	11	25-43	36.6	0.2-1.0	0.7					
Gobiidae unid.	gobies	6	26-29	27.5	0.1-0.2	0.1					
Orthonopias triacis	snubnose sculpin	1	58	58.0	3.5	3.5					
Porichthys notatus	plainfin midshipman	2	47-58	52.5	1.3-2.3	1.8					
Sardinops sagax	Pacific sardine	1	111	111.0	10.5	10.5					
Scorpaenichthys marmoratus	cabezon	2	36-64	50.0	1.0-6.3	3.7					
Syngnathus spp.	pipefishes	17	110-205	160.6	0.3-3.0	1.3					
INVERTEBRATES											
Cancer antennarius	brown rock crab	4	38-47	42.3	14.7-30.1	20.9					
Cancer jordani	hairy rock crab	10	10-22	17.4	0.3-3.5	2.0					
Cancer productus	red rock crab	7	13-32	20.0	0.5-5.5	2.7					
Cancer spp.	cancer crabs	11	10-23	14.8	0.4-3.5	1.3					
Crangon nigricauda	black-tailed bay shrimp	4	7-13	9.3	0.5-2.5	1.2					
Crangon nigromaculata	spotted bay shrimp	146	7-15	10.5	0.4-2.8	1.2					
Crangon spp.	bay shrimp	66	7-18	10.4	0.3-4.1	1.3					
Emerita analoga	mole crab	1	13	13.0	0.7	0.7					
Heptacarpus spp.	tidepool shrimps	52	4-13	8.0	0.1-0.9	0.5					
Pachygrapsus crassipes	striped shore crab	4	13-28	22.5	1.3-10.1	6.4					
Pandalus spp.	unidentified shrimp	2	14-18	16.0	1.7-1.9	1.8					
Pugettia producta	northern kelp crab	5	11-27	19.2	0.9-12.5	5.6					
Spirontocaris spp.	broken-back shrimp	1	9	9.0	0.8	0.8					

*Totals for Units 1&2 include bar rack sample totals.

Table B-21. Moss Landing Power Plant Impingement Abundance Survey 21, March 29, 2006.

		Units 1&2*					Units 6&7				
			Length		Weight			Length		Weight	
Taxon	Common Name	Count	Range (mm)	Average	Range (g)	Average	Count	Range (mm)	Average	Range (g)	Average
FISHES											
Artedius notospilotus	bonyhead sculpin	1	113	113.0	36.4	36.4	Not operating, therefore no sampling.				
Atherinops affinis	topsmelt	1	65	65.0	2.1	2.1					
Citharichthys spp.	sanddabs	3	16-31	26.0	<0.1-0.5	0.3					
Citharichthys stigmaeus	speckled sanddab	68	29-38	33.7	0.1-0.6	0.4					
Clevelandia ios	arrow goby	1	55	55.0	1.7	1.7					
Gasterosteus aculeatus	threespine stickleback	1	-	-	-	-					
Rimicola muscarum	kelp clingfish	2	45-46	45.5	0.8-1.1	1.0					
Symphurus atricauda	California tonguefish	1	43	43.0	0.5	0.5					
Syngnathus spp.	pipefishes	3	113-203	161.3	0.4-2.3	1.2					
INVERTEBRATES											
Blepharipoda occidentalis	spiny mole crab	1	20	20.0	2.5	2.5					
Cancer antennarius	brown rock crab	3	66-70	68.0	65.3-74.8	70.0					
Cancer anthonyi	yellow crab	1	20	20.0	1.2	1.2					
Cancer jordani	hairy rock crab	16	9-27	15.3	0.2-5.0	1.4					
Cancer productus	red rock crab	5	16-58	30.8	0.7-28.6	8.7					
Cancer spp.	cancer crabs	7	8-13	10.7	0.2-0.8	0.5					
Crangon nigromaculata	spotted bay shrimp	3	9-16	11.3	0.6-4.0	1.9					
Crangon spp.	bay shrimp	4	4-14	10.0	0.1-3.3	1.5					
Emerita analoga	mole crab	3	11-17	13.7	0.9-1.6	1.2					
Hemigrapsus oregonensis	yellow shore crab	1	11	11.0	0.6	0.6					
Heptacarpus spp.	tidepool shrimps	30	3-11	8.4	0.1-0.7	0.4					
Pachygrapsus crassipes	striped shore crab	1	12	12.0	1.1	1.1					
Pugettia producta	northern kelp crab	4	11-21	15.8	0.5-4.3	2.2					

*Totals for Units 1&2 include bar rack sample totals.

Table B-22. Moss Landing Power Plant Impingement Abundance Survey 22, April 12, 2006.

Taxon	Common Name	Units 1&2* Count	Length Range (mm)	Length Average (mm)	Weight Range (g)	Weight Average (g)	Units 6&7 Count	Length Range (mm)	Length Average (mm)	Weight Range (g)	Weight Average (g)
FISHES											
Atherinopsidae unid.	silversides	1	-	-	-	-	Not operating, therefore no sampling.				
Citharichthys spp.	sanddabs	1	32	32.0	0.2	0.2					
Citharichthys stigmaeus	speckled sanddab	6	31-40	35.0	0.3-0.8	0.6					
Clevelandia ios	arrow goby	1	46	46.0	0.7	0.7					
Gasterosteus aculeatus	threespine stickleback	2	28-46	37.0	0.2-1.4	0.8					
Lepidogobius lepidus	bay goby	4	74-90	84.5	4.2-7.2	5.8					
Leptocottus armatus	Pacific staghorn sculpin	1	24	24.0	0.1	0.1					
Rhinogobiops nicholsi	blackeye goby	1	52	52.0	2.0	2.0					
Scorpaenichthys marmoratus	cabezon	4	50-75	62.3	2.6-8.8	5.7					
Syngnathus spp.	pipefishes	5	95-224	169.6	0.1-3.8	1.4					
INVERTEBRATES											
Cancer antennarius	brown rock crab	8	15-81	53.6	1.1-125.4	49.6					
Cancer anthonyi	yellow crab	1	45	45.0	14.9	14.9					
Cancer jordani	hairy rock crab	8	9-26	16.9	0.2-3.8	1.6					
Cancer productus	red rock crab	7	10-82	50.7	0.4-99.1	38.1					
Cancer spp.	cancer crabs	2	6-7	6.5	0.1	0.1					
Crangon franciscorum	Franciscan bay shrimp	1	10	10.0	0.9	0.9					
Crangon nigricauda	black-tailed bay shrimp	2	7-13	10.0	0.2-2.6	1.4					
Emerita analoga	mole crab	1	22	22.0	1.6	1.6					
Hemigrapsus oregonensis	yellow shore crab	1	11	11.0	0.4	0.4					
Heptacarpus spp.	tidepool shrimps	8	3-9	5.8	0.1-1.4	0.5					
Pachygrapsus crassipes	striped shore crab	2	15-22	18.5	2.2-8.1	5.2					
Pugettia producta	northern kelp crab	9	11-38	19.9	1.2-25.6	6.7					

*Totals for Units 1&2 include bar rack sample totals.

Table B-23. Moss Landing Power Plant Impingement Abundance Survey 23, April 19, 2006.

		Units 1&2*					Units 6&7				
			Length		Weight			Length		Weight	
Taxon	Common Name	Count	Range (mm)	Average	Range (g)	Average	Count	Range (mm)	Average	Range (g)	Average
FISHES											
Acanthogobius flavimanus	yellowfin goby	1	25	25.0	<0.1	<0.1	Not operating, therefore no sampling.				
Lepidogobius lepidus	bay goby	1	79	79.0	4.9	4.9					
Parophrys vetulus	English sole	1	17	17.0	<0.1	<0.1					
Scorpaenichthys marmoratus	cabezon	1	89	89.0	18.6	18.6					
INVERTEBRATES											
Cancer antennarius	brown rock crab	1	38	38.0	15.6	15.6					
Cancer jordani	hairy rock crab	2	13-14	13.5	0.7-1.2	1.0					
Cancer spp.	cancer crabs	1	8	8.0	0.2	0.2					
Crangon nigricauda	black-tailed bay shrimp	1	9	9.0	0.7	0.7					
Crangon spp.	bay shrimp	1	4	4.0	<0.1	<0.1					
Hemigrapsus oregonensis	yellow shore crab	1	9	9.0	0.3	0.3					
Heptacarpus spp.	tidepool shrimps	4	4-8	6.3	0.2-0.5	0.3					
Pachygrapsus crassipes	striped shore crab	6	8-26	17.3	0.5-5.6	3.4					
Pugettia producta	northern kelp crab	2	5-15	10.0	0.1-2.0	1.1					

*Totals for Units 1&2 include bar rack sample totals.

Table B-24. Moss Landing Power Plant Impingement Abundance Survey 24, April 24, 2006.

Taxon	Common Name	Units 1&2* Count	Units 1&2* Length Range (mm)	Units 1&2* Length Average (mm)	Units 1&2* Weight Range (g)	Units 1&2* Weight Average (g)	Units 6&7 Count	Units 6&7 Length Range (mm)	Units 6&7 Length Average (mm)	Units 6&7 Weight Range (g)	Units 6&7 Weight Average (g)
FISHES											
Atherinops affinis	topsmelt	-	-	-	-	-	4	74-100	84.3	2.9-8.0	5.1
Cebidichthys violaceus	monkeyface eel	-	-	-	-	-	1	148	148.0	17.0	17.0
Chilara taylori	spotted cusk-eel	-	-	-	-	-	1	144	144.0	8.7	8.7
Citharichthys stigmaeus	speckled sanddab	-	-	-	-	-	67	38-83	65.2	0.8-10.2	5.0
Clevelandia ios	arrow goby	1	49	49.0	0.8	0.8	-	-	-	-	-
Clupea pallasii	Pacific herring	-	-	-	-	-	1	90	90.0	6.8	6.8
Cymatogaster aggregata	shiner surfperch	-	-	-	-	-	4	81-113	95.0	12.3-38.0	23.2
Engraulis mordax	northern anchovy	-	-	-	-	-	51	64-139	89.4	2.2-25.3	5.6
Gasterosteus aculeatus	threespine stickleback	-	-	-	-	-	3	39-41	40.3	0.9-1.4	1.1
Lepidogobius lepidus	bay goby	-	-	-	-	-	6	80-92	85.8	4.7-7.8	6.4
Leptocottus armatus	Pacific staghorn sculpin	-	-	-	-	-	1	105	105.0	17.4	17.4
Myliobatis californica	bat ray	-	-	-	-	-	1	290	290.0	314.3	314.3
Phanerodon furcatus	white surfperch	-	-	-	-	-	5	81-188	141.3	21.2-154.1	83.8
Platyrhinoidis triseriata	thornback	-	-	-	-	-	1	140	140.0	148.5	148.5
Porichthys notatus	plainfin midshipman	-	-	-	-	-	2	159-171	165.0	53.9-66.1	60.0
Rimicola muscarum	kelp clingfish	1	33	33.0	0.3	0.3	-	-	-	-	-
Sardinops sagax	Pacific sardine	-	-	-	-	-	10	101-127	112.7	7.1-15.2	11.6
Scorpaenichthys marmoratus	cabezon	1	43	43.0	1.6	1.6	1	68	68.0	6.1	6.1
Sebastes auriculatus	brown rockfish	-	-	-	-	-	1	104	104.0	28.6	28.6
Spirinchus starksi	night smelt	-	-	-	-	-	7	96-109	102.0	6.3-10.8	8.7
Symphurus atricauda	California tonguefish	1	53	53.0	1.0	1.0	1	65	65.0	2.2	2.2
unidentified fish, damaged	unidentified damaged fish	-	-	-	-	-	1	-	-	0.8	0.8
		-	-	-	-	-	-	-	-	-	-
INVERTEBRATES		-	-	-	-	-	-	-	-	-	-
Cancer antennarius	brown rock crab	2	41-68	54.5	17.0-66.6	41.8	11	66-141	83.0	45.6-389.4	103.7
Cancer anthonyi	yellow crab	-	-	-	-	-	1	109	109.0	194.8	194.8
Cancer gracilis	slender crab	-	-	-	-	-	2	81-89	85.0	117.0-119.4	118.2
Cancer jordani	hairy rock crab	4	12-22	17.5	0.3-3.5	1.8	-	-	-	-	-
Cancer productus	red rock crab	-	-	-	-	-	6	56-107	83.2	23.2-169.7	92.1
Cancer spp.	cancer crabs	-	-	-	-	-	10	54-141	89.8	28.6-293.9	117.2
Crangon franciscorum	Franciscan bay shrimp	-	-	-	-	-	6	10-14	12.5	0.7-2.4	1.8
Crangon nigricauda	black-tailed bay shrimp	-	-	-	-	-	1	10	10.0	0.9	0.9
Crangon nigromaculata	spotted bay shrimp	-	-	-	-	-	173	7-14	9.7	0.5-2.8	1.0
Crangon spp.	bay shrimp	-	-	-	-	-	12	8-17	12.3	0.7-2.8	1.7
Heptacarpus spp.	tidepool shrimps	7	6-11	8.9	<0.1-0.4	0.3	31	7-16	8.5	0.1-2.6	0.6
Lophopanopeus spp.	black-clawed crabs	-	-	-	-	-	3	10-14	11.7	0.9-2.0	1.4

*Totals for Units 1&2 include bar rack sample totals.

(continued)

Table B-24 continued. Moss Landing Power Plant Impingement Abundance Survey 24, April 24, 2006.

Taxon	Common Name	Units 1&2* Count	Units 1&2* Length Range (mm)	Units 1&2* Length Average (mm)	Units 1&2* Weight Range (g)	Units 1&2* Weight Average (g)	Units 6&7 Count	Units 6&7 Length Range (mm)	Units 6&7 Length Average (mm)	Units 6&7 Weight Range (g)	Units 6&7 Weight Average (g)
INVERTEBRATES (continued)											
Pachygrapsus crassipes	striped shore crab	3	15-19	17.0	2.1-5.6	3.4	1	20	20.0	5.8	5.8
Pandalopsis dispar	sidestriped shrimp	-	-	-	-	-	1	20	20.0	1.9	1.9
Pandalus danae	dock shrimp	-	-	-	-	-	1	20	20.0	4.8	4.8
Pugettia producta	northern kelp crab	-	-	-	-	-	5	12-35	20.4	2.1-30.9	10.9

*Totals for Units 1&2 include bar rack sample totals.

Table B-25. Moss Landing Power Plant Impingement Abundance Survey 25, May 2, 2006.

		Units 1&2*					Units 6&7				
			Length		Weight			Length		Weight	
Taxon	Common Name	Count	Range (mm)	Average	Range (g)	Average	Count	Range (mm)	Average	Range (g)	Average
FISHES											
Artedius harringtoni	scalyhead sculpin	Not operating, therefore no sampling.					1	69	69.0	8.4	8.4
Atherinops affinis	topsmelt						1	157	157.0	37.6	37.6
Citharichthys stigmaeus	speckled sanddab						13	41-85	61.4	0.9-9.0	3.9
Clupea pallasii	Pacific herring						1	93	93.0	5.5	5.5
Cymatogaster aggregata	shiner surfperch						1	85	85.0	14.4	14.4
Engraulis mordax	northern anchovy						7	82-105	94.0	3.4-9.5	6.2
Gasterosteus aculeatus	threespine stickleback						3	5-59	33.0	0.5-2.3	1.5
Lepidogobius lepidus	bay goby						2	89-92	90.5	7.5-7.7	7.6
Parophrys vetulus	English sole						1	42	42.0	1.1	1.1
Platyrhinoidis triseriata	thornback						1	670	670.0	2,220.0	2,220.0
Porichthys notatus	plainfin midshipman						3	123-178	155.3	24.5-86.1	54.9
Rimicola muscarum	kelp clingfish						2	4.8-5.4	5.1	0.8-1.0	0.9
Scorpaenichthys marmoratus	cabezon						1	86	86.0	15.0	15.0
Spirinchus starksi	night smelt						2	104-110	107.0	7.7-8.6	8.2
Syngnathus spp.	pipefishes						1	159	159.0	1.3	1.3
Torpedo californica	Pacific electric ray						1	175	175.0	230.5	230.5
INVERTEBRATES											
Cancer productus	red rock crab						3	73-138	102.0	55.4-299.7	156.8
Crangon nigricauda	black-tailed bay shrimp						3	9-10	9.3	0.7-0.8	0.8
Crangon nigromaculata	spotted bay shrimp						3	9-12	10.3	0.6-1.4	1.0
Heptacarpus spp.	tidepool shrimps						3	7-12	8.7	0.3-0.6	0.4
Neotrypaea californiensis	ghost bay shrimp						1	13	13.0	2.4	2.4

*Totals for Units 1&2 include bar rack sample totals.

Table B-26. Moss Landing Power Plant Impingement Abundance Survey 26, May 10, 2006.

Taxon	Common Name	Units 1&2* Count	Units 1&2* Length Range (mm)	Units 1&2* Length Average (mm)	Units 1&2* Weight Range (g)	Units 1&2* Weight Average (g)	Units 6&7 Count	Units 6&7 Length Range (mm)	Units 6&7 Length Average (mm)	Units 6&7 Weight Range (g)	Units 6&7 Weight Average (g)
FISHES											
Atherinops affinis	topsmelt	-	-	-	-	-	8	79-110	98.8	3.5-10.5	8.3
Chilara taylori	spotted cusk-eel	-	-	-	-	-	1	252	252.0	71.8	71.8
Citharichthys stigmaeus	speckled sanddab	-	-	-	-	-	29	41-89	66.5	1.2-11.0	5.4
Clupea pallasii	Pacific herring	-	-	-	-	-	1	187	187.0	73.5	73.5
Cymatogaster aggregata	shiner surfperch	-	-	-	-	-	2	96-108	102.0	25.6-30.5	28.1
Engraulis mordax	northern anchovy	9	80-103	91.1	4.0-9.1	6.3	204	81-115	101.9	3.1-11.1	7.4
Gasterosteus aculeatus	threespine stickleback	-	-	-	-	-	6	39-45	42.3	0.8-1.4	1.1
Lepidogobius lepidus	bay goby	-	-	-	-	-	3	69-93	83.0	3.1-8.9	6.3
Leptocottus armatus	Pacific staghorn sculpin	-	-	-	-	-	1	119	119.0	33.6	33.6
Platichthys stellatus	starry flounder	-	-	-	-	-	1	108	108.0	21.8	21.8
Parophrys vetulus	English sole	1	85	85.0	6.4	6.4	3	67-102	79.7	3.4-11.3	8.6
Sardinops sagax	Pacific sardine	-	-	-	-	-	2	125-131	128.0	13.9-25.2	19.6
Scorpaenichthys marmoratus	cabezon	2	118-143	130.5	26.5-68.0	47.3	2	102-142	122.0	26.3-84.8	55.6
Sebastes auriculatus	brown rockfish	-	-	-	-	-	1	92	92.0	17.8	17.8
Syngnathus spp.	pipefishes	10	136-226	172.4	0.2-4.0	1.4	4	175-195	182.8	1.5-2.4	1.8
Torpedo californica	Pacific electric ray	-	-	-	-	-	4	147-228	175.5	139.3-488.1	260.1
INVERTEBRATES											
Cancer antennarius	brown rock crab	2	44-76	60.0	21.8-96.1	58.9	1	71	71.0	48.7	48.7
Cancer gracilis	slender crab	-	-	-	-	-	2	83-88	85.5	124.9-140.0	132.5
Cancer jordani	hairy rock crab	1	22	22.0	1.5	1.5	-	-	-	-	-
Cancer productus	red rock crab	2	11-91	51.0	0.4-121.7	61.0	2	95-99	97.0	119.1-124.0	121.5
Cancer spp.	cancer crabs	1	12	12.0	0.4	0.4	-	-	-	-	-
Crangon franciscorum	Franciscan bay shrimp	-	-	-	-	-	3	6-16	10.3	0.4-2.5	1.2
Crangon nigricauda	black-tailed bay shrimp	-	-	-	-	-	3	7-8	7.7	1.0-1.2	1.1
Crangon nigromaculata	spotted bay shrimp	-	-	-	-	-	120	7-19	10.9	0.8-2.9	1.3
Emerita analoga	mole crab	-	-	-	-	-	2	17-22	19.5	1.2-3.8	2.5
Hemigrapsus oregonensis	yellow shore crab	1	12	12.0	0.3	0.3	-	-	-	-	-
Heptacarpus spp.	tidepool shrimps	2	9	9.0	0.2	0.2	2	9-12	10.5	0.3-0.9	0.6
Lophopanopeus bellus	black-claw crestleg crab	1	16	16.0	1.0	1.0	-	-	-	-	-
Pachygrapsus crassipes	striped shore crab	4	17-28	20.5	3.0-9.3	5.3	1	14	14.0	1.8	1.8
Pandalopsis dispar	sidestriped shrimp	-	-	-	-	-	2	6-22	14.0	0.4-4.1	2.2
Pugettia producta	northern kelp crab	9	7-26	16.2	0.1-13.7	3.1	3	8-21	15.3	0.9-5.8	3.2

*Totals for Units 1&2 include bar rack sample totals.

Table B-27. Moss Landing Power Plant Impingement Abundance Survey 27, May 17, 2006.

Taxon	Common Name	Units 1&2* Count	Length Range (mm)	Length Average (mm)	Weight Range (g)	Weight Average (g)	Units 6&7 Count	Length Range (mm)	Length Average (mm)	Weight Range (g)	Weight Average (g)
FISHES											
Atherinops affinis	topsmelt	1	148	148.0	26.3	26.3	Not operating, therefore no sampling.				
Citharichthys stigmaeus	speckled sanddab	1	55	55.0	3.0	3.0					
Clevelandia ios	arrow goby	2	43-50	46.5	0.7-1.4	1.0					
Engraulis mordax	northern anchovy	5	100-106	103.0	10.3-13.0	11.7					
Gasterosteus aculeatus	threespine stickleback	1	39	39.0	0.9	0.9					
Lepidogobius lepidus	bay goby	3	64-86	73.3	2.9-7.4	4.7					
Leptocottus armatus	Pacific staghorn sculpin	1	122	122.0	37.0	37.0					
Leuresthes tenuis	California grunion	1	81	81.0	3.2	3.2					
Neoclinus uninotatus	onespot fringehead	1	132	132.0	20.9	20.9					
Porichthys notatus	plainfin midshipman	1	124	124.0	25.4	25.4					
Sardinops sagax	Pacific sardine	3	108-121	116.3	11.7-15.3	13.9					
Scorpaenichthys marmoratus	cabezon	4	35-110	87.5	1.4-36.7	23.9					
Syngnathus spp.	pipefishes	4	133-211	167.8	0.5-2.2	1.1					
Torpedo californica	Pacific electric ray	1	145	145.0	151.9	151.9					
unidentified fish, damaged	unidentified damaged fish	1	-	-	-	-					
INVERTEBRATES											
Cancer antennarius	brown rock crab	1	47	47.0	20.8	20.8					
Cancer jordani	hairy rock crab	1	17	17.0	1.6	1.6					
Cancer productus	red rock crab	2	15-18	16.3	0.4-0.8	0.6					
Crangon franciscorum	Franciscan bay shrimp	2	10	10.0	0.7-0.9	0.8					
Crangon nigricauda	black-tailed bay shrimp	1	10	10.0	1.0	1.0					
Crangon nigromaculata	spotted bay shrimp	1	14	14.0	2.6	2.6					
Emerita analoga	mole crab	1	15	15.0	0.7	0.7					
Hemigrapsus oregonensis	yellow shore crab	1	17	17.0	2.0	2.0					
Loligo opalescens	market squid	1	-	-	-	-					
Neotrypaea californiensis	ghost bay shrimp	2	13-18	15.5	2.5-5.0	3.8					
Pachygrapsus crassipes	striped shore crab	13	8-32	17.3	0.1-9.1	2.9					
Pugettia producta	northern kelp crab	9	13-44	21.8	0.9-30.7	6.8					

*Totals for Units 1&2 include bar rack sample totals.

Table B-28. Moss Landing Power Plant Impingement Abundance Survey 28, May 23, 2006.

Taxon	Common Name	Units 1&2* Count	Units 1&2* Length Range (mm)	Units 1&2* Length Average (mm)	Units 1&2* Weight Range (g)	Units 1&2* Weight Average (g)	Units 6&7 Count	Units 6&7 Length Range (mm)	Units 6&7 Length Average (mm)	Units 6&7 Weight Range (g)	Units 6&7 Weight Average (g)
FISHES											
Ammodytes hexapterus	Pacific sand lance	-	-	-	-	-	1	63	63.0	1.5	1.5
Atherinops affinis	topsmelt	2	66	66.0	2.5-2.7	2.6	4	57-95	78.8	1.4-9.6	5.4
Citharichthys sordidus	Pacific sanddab	-	-	-	-	-	1	78	78.0	5.7	5.7
Citharichthys spp.	sanddabs	2	33-34	33.5	0.4-0.5	0.5	-	-	-	-	-
Citharichthys stigmaeus	speckled sanddab	3	34-78	61.7	0.6-6.4	4.4	44	38-88	67.4	0.8-12.6	5.4
Clupea pallasii	Pacific herring	-	-	-	-	-	2	99-145	122.0	9.8-34.1	21.9
Cottus asper	prickly sculpin	-	-	-	-	-	2	113-122	117.5	27.0-32.7	29.9
Cymatogaster aggregata	shiner surfperch	-	-	-	-	-	5	85-112	93.6	14.8-36.6	20.9
Engraulis mordax	northern anchovy	3	87-102	94.5	2.9-9.1	6.0	4	91-103	98.8	5.3-9.1	7.5
Gasterosteus aculeatus	threespine stickleback	6	50-66	56.8	1.9-3.6	2.3	22	39-63	48.4	0.7-2.6	1.7
Hyperprosopon argenteum	walleye surfperch	-	-	-	-	-	1	44	44.0	1.5	1.5
Lepidogobius lepidus	bay goby	1	78	78.0	4.5	4.5	2	79	79.0	5.9-6.6	6.3
Leptocottus armatus	Pacific staghorn sculpin	-	-	-	-	-	1	85	85.0	10.6	10.6
Parophrys vetulus	English sole	1	57	57.0	2.6	2.6	12	49-89	62.7	1.4-8.7	3.6
Phanerodon furcatus	white surfperch	-	-	-	-	-	3	35-37	36.3	0.8-1.1	1.0
Platichthys stellatus	starry flounder	2	47-59	53.0	1.9-3.8	2.8	12	33-149	52.1	0.7-74.7	7.8
Porichthys notatus	plainfin midshipman	3	58-142	93.3	1.9-46.5	18.0	19	72-175	133.1	3.9-75.1	37.9
Sardinops sagax	Pacific sardine	1	100	100.0	7.6	7.6	12	96-122	112.5	7.0-15.0	11.7
Scorpaenichthys marmoratus	cabezon	1	38	38.0	1.3	1.3	3	34-121	91.0	0.9-43.9	28.1
Sebastes auriculatus		-	-	-	-	-	1	103	103.0	27.8	27.8
Sebastes paucispinis		-	-	-	-	-	1	60	60.0	3.7	3.7
Spirinchus starksi	night smelt	3	100-104	102.7	6.1-10.0	8.6	17	95-109	103.5	5.6-12.5	8.0
Symphurus atricauda	California tonguefish	1	66	66.0	2.6	2.6	3	85-115	95.7	5.6-12.3	8.2
Syngnathus spp.	pipefishes	7	132-228	178.9	0.7-3.6	1.8	2	160	160.0	0.9	0.9
unidentified fish, damaged	unidentified damaged fish	-	-	-	-	-	1	-	-	-	-
INVERTEBRATES											
Cancer antennarius	brown rock crab	2	60-65	62.5	53.7-55.8	54.8	2	87-91	89.0	98.3-103.5	100.9
Cancer jordani	hairy rock crab	4	17-20	13.8	1.9-2.3	1.6	-	-	-	-	-
Cancer productus	red rock crab	3	34-66	50.0	6.7-45.3	26.0	3	93-118	107.0	120.5-187.3	159.5
Crangon franciscorum	Franciscan bay shrimp	1	13	13.0	2.5	2.5	1	14	14.0	2.4	2.4
Crangon nigromaculata	spotted bay shrimp	4	10-14	11.8	0.8-2.4	1.4	329	9-15	11.5	0.6-2.9	1.3
Crangon spp.	bay shrimp	10	7-11	8.7	0.3-0.9	0.5	23	7-17	9.6	0.4-2.9	0.8

*Totals for Units 1&2 include bar rack sample totals.

(continued)

Table B-28 continued. Moss Landing Power Plant Impingement Abundance Survey 28, May 23, 2006.

Taxon	Common Name	Units 1&2*					Units 6&7				
			Length		Weight			Length		Weight	
		Count	Range (mm)	Average	Range (g)	Average	Count	Range (mm)	Average	Range (g)	Average
INVERTEBRATES (continued)											
Emerita analoga	mole crab	1	15	15.0	1.6	1.6	1	18	18.0	2.2	2.2
Hemigrapsus oregonensis	yellow shore crab	1	12	12.0	0.8	0.8	-	-	-	-	-
Heptacarpus spp.	tidepool shrimps	3	5-8	6.7	0.2-0.7	0.4	8	7-9	8.1	0.4-0.6	0.5
Neotrypaea californiensis	ghost bay shrimp	-	-	-	-	-	1	13	13.0	2.5	2.5
Pachycheles spp.	porcelain crabs	1	-	-	-	-	-	-	-	-	-
Pachygrapsus crassipes	striped shore crab	4	18-33	23.5	4.9-6.0	5.5	3	22-30	25.0	5.4-6.7	6.2
Pugettia producta	northern kelp crab	3	17-32	26.0	1.9-13.1	7.7	6	8-25	18.8	0.7-8.0	4.3

*Totals for Units 1&2 include bar rack sample totals.

Table B-29. Moss Landing Power Plant Impingement Abundance Survey 29, June 1, 2006.

Taxon	Common Name	Units 1&2* Count	Length Range (mm)	Length Average (mm)	Weight Range (g)	Weight Average (g)	Units 6&7 Count	Length Range (mm)	Length Average (mm)	Weight Range (g)	Weight Average (g)
FISHES											
Atherinopsidae unid.	silversides	1	-	-	-	-	Not operating, therefore no sampling.				
Aulorhynchus flavidus	tubesnout	1	68	68.0	0.3	0.3					
Gasterosteus aculeatus	threespine stickleback	1	40	40.0	1.1	1.1					
Lepidogobius lepidus	bay goby	1	80	80.0	5.5	5.5					
Leptocottus armatus	Pacific staghorn sculpin	1	80	80.0	9.4	9.4					
Porichthys notatus	plainfin midshipman	4	134-162	143.8	33.0-60.3	42.8					
Rimicola muscarum	kelp clingfish	1	37	37.0	0.4	0.4					
Scorpaenichthys marmoratus	cabezon	4	39-120	74.0	1.5-47.6	15.6					
Syngnathus spp.	pipefishes	9	118-173	150.7	0.3-1.1	0.7					
Torpedo californica	Pacific electric ray	1	187	187.0	309.8	309.8					
INVERTEBRATES											
Cancer antennarius	brown rock crab	2	78-80	79.0	58.7-69.2	63.9					
Cancer jordani	hairy rock crab	1	23	23.0	2.9	2.9					
Cancer productus	red rock crab	1	35	35.0	7.6	7.6					
Cancer spp.	cancer crabs	5	12-18	14.4	0.7-2.3	1.1					
Crangon nigromaculata	spotted bay shrimp	2	8-10	9.0	1.3-2.8	2.0					
Pachygrapsus crassipes	striped shore crab	7	14-30	19.9	1.4-10.9	4.6					
Pugettia producta	northern kelp crab	7	7-28	18.3	0.6-104.0	19.5					

*Totals for Units 1&2 include bar rack sample totals.

Table B-30. Moss Landing Power Plant Impingement Abundance Survey 30, June 7, 2006.

		Units 1&2*					Units 6&7				
			Length		Weight			Length		Weight	
Taxon	Common Name	Count	Range (mm)	Average	Range (g)	Average	Count	Range (mm)	Average	Range (g)	Average
FISHES											
Atherinops affinis	topsmelt	1	119	119.0	16.1	16.1	Not operating, therefore no sampling.				
Cymatogaster aggregata	shiner surfperch	1	-	-	-	-					
Gasterosteus aculeatus	threespine stickleback	1	53	53.0	2.3	2.3					
Leptocottus armatus	Pacific staghorn sculpin	1	70	70.0	5.5	5.5					
Phanerodon furcatus	white surfperch	1	35	35.0	0.7	0.7					
Scorpaenichthys marmoratus	cabezon	2	88-93	90.5	17.0-20.3	18.6					
Syngnathus spp.	pipefishes	11	53-251	164.4	0.1-4.1	1.3					
INVERTEBRATES											
Cancer antennarius	brown rock crab	2	53-65	59.0	32.1-33.9	33.0					
Cancer productus	red rock crab	1	52	52.0	20.2	20.2					
Crangon nigromaculata	spotted bay shrimp	7	8-13	10.7	0.4-2.5	1.3					
Crangon spp.	bay shrimp	1	6	6.0	0.3	0.3					
Grapsidae unid.	shore crabs	2	10-12	11.0	0.5	0.5					
Hemigrapsus oregonensis	yellow shore crab	1	24	24.0	6.3	6.3					
Pachygrapsus crassipes	striped shore crab	2	20-21	20.5	3.3-4.6	3.9					
Protothaca staminea	Pacific littleneck	3	22-49	37.0	4.1-44.7	25.3					
Pugettia producta	northern kelp crab	6	16-36	25.3	3.4-19.0	8.9					

*Totals for Units 1&2 include bar rack sample totals.

Table B-31. Moss Landing Power Plant Impingement Abundance Survey 31, June 14, 2006.

		Units 1&2*					Units 6&7				
			Length		Weight			Length		Weight	
Taxon	Common Name	Count	Range (mm)	Average	Range (g)	Average	Count	Range (mm)	Average	Range (g)	Average
FISHES											
Atherinops affinis	topsmelt	1	75	75.0	3.1	3.1	Not operating, therefore no sampling.				
Atherinopsidae unid.	silversides	1	26	26.0	0.2	0.2					
Citharichthys spp.	sanddabs	1	29	29.0	0.3	0.3					
Gasterosteus aculeatus	threespine stickleback	2	27-41	34.0	0.2-0.9	0.5					
Lepidogobius lepidus	bay goby	1	93	93.0	8.6	8.6					
Leptocottus armatus	Pacific staghorn sculpin	1	81	81.0	9.5	9.5					
Parophrys vetulus	English sole	1	56	56.0	2.6	2.6					
Phanerodon furcatus	white surfperch	1	124	124.0	49.8	49.8					
Scorpaenichthys marmoratus	cabezon	2	52-53	52.5	3.6-4.3	4.0					
Syngnathus spp.	pipefishes	5	163-253	211.2	0.9-6.0	3.1					
INVERTEBRATES											
Cancer antennarius	brown rock crab	2	52-53	52.5	34.8-43.6	39.2					
Cancer jordani	hairy rock crab	1	22	22.0	3.0	3.0					
Cancer magister	dungeness crab	1	19	19.0	1.0	1.0					
Cancer productus	red rock crab	1	95	95.0	101.7	101.7					
Cancer spp.	cancer crabs	2	15-17	16.0	0.9-1.3	1.1					
Crangon nigromaculata	spotted bay shrimp	8	9-14	11.4	0.6-3.0	1.4					
Crangon spp.	bay shrimp	38	5-11	8.0	0.1-1.0	0.4					
Emerita analoga	mole crab	1	14	14.0	0.8	0.8					
Hemigrapsus oregonensis	yellow shore crab	2	11-20	15.5	0.7-2.7	1.7					
Heptacarpus spp.	tidepool shrimps	2	8-9	8.5	0.3-0.6	0.5					
Loligo opalescens	market squid	1	214	214.0	24.1	24.1					
Pachygrapsus crassipes	striped shore crab	4	12-24	16.0	0.7-6.4	2.7					
Pugettia producta	northern kelp crab	12	8-48	27.4	1.0-40.1	12.8					

*Totals for Units 1&2 include bar rack sample totals.

Table B-32. Moss Landing Power Plant Impingement Abundance Survey 32, June 21, 2006.

Taxon	Common Name	Units 1&2* Count	Units 1&2* Length Range (mm)	Units 1&2* Length Average (mm)	Units 1&2* Weight Range (g)	Units 1&2* Weight Average (g)	Units 6&7 Count	Units 6&7 Length Range (mm)	Units 6&7 Length Average (mm)	Units 6&7 Weight Range (g)	Units 6&7 Weight Average (g)
FISHES											
Agonidae unid.	poachers	1	48	48.0	0.7	0.7	-	-	-	-	-
Artedius notospilotus	bonyhead sculpin	-	-	-	-	-	2	50-58	54.0	2.3-3.7	3.0
Atherinops affinis	topsmelt	2	60-99	79.5	1.5-5.9	3.7	60	47-144	101.9	0.5-28.7	10.6
Citharichthys stigmaeus	speckled sanddab	1	84	84.0	10.2	10.2	57	46-92	66.8	1.6-11.2	5.4
Clevelandia ios	arrow goby	3	48-53	50.3	0.8-1.5	1.1	1	54	54.0	0.8	0.8
Clupea pallasii	Pacific herring	-	-	-	-	-	4	86-155	115.8	5.6-33.1	15.1
Cymatogaster aggregata	shiner surfperch	1	35	35.0	0.8	0.8	16	34-124	76.8	0.2-42.6	15.7
Cyprinidae unid.	minnows and carps	-	-	-	-	-	2	32-33	32.5	0.4-0.9	0.6
Embiotocidae unid. (juv.)	juvenile surfperches	-	-	-	-	-	14	37-52	48.7	1.1-3.0	2.4
Engraulis mordax	northern anchovy	-	-	-	-	-	5	83-115	100.2	3.9-13.9	8.0
Gasterosteus aculeatus	threespine stickleback	1	70	70.0	4.4	4.4	10	37-68	52.7	0.7-3.7	2.0
Hyperprosopon argenteum	walleye surfperch	-	-	-	-	-	5	48-57	51.4	2.0-4.3	2.5
Lepidogobius lepidus	bay goby	4	78-95	84.0	4.4-8.5	6.0	9	76-95	86.8	5.2-8.5	6.9
Leptocottus armatus	Pacific staghorn sculpin	10	69-92	79.1	6.0-13.7	9.0	12	60-122	82.8	3.5-37.5	11.4
Myliobatis californica	bat ray	-	-	-	-	-	3	304-342	325.7	271.2-500.0	403.7
Parophrys vetulus	English sole	2	55-57	56.0	2.5	2.5	35	42-92	63.1	1.5-11.6	4.3
Peprilus simillimus	Pacific butterfish	-	-	-	-	-	1	115	115.0	36.1	36.1
Phanerodon furcatus	white surfperch	1	34	34.0	0.6	0.6	42	35-176	51.3	0.8-110.7	5.0
Platichthys stellatus	starry flounder	1	60	60.0	4.5	4.5	5	44-56	52.4	0.9-4.4	3.2
Platyrhinoidis triseriata	thornback	-	-	-	-	-	2	270-336	303.0	1,050.0-2,100.0	1,575.0
Porichthys notatus	plainfin midshipman	6	111-150	134.7	18.0-40.4	31.5	11	124-155	139.4	26.2-63.2	38.5
Sardinops sagax	Pacific sardine	-	-	-	-	-	5	87-130	114.4	5.1-16.0	12.0
Scorpaenichthys marmoratus	cabezon	1	122	122.0	53.4	53.4	1	45	45.0	2.7	2.7
Spirinchus starksi	night smelt	-	-	-	-	-	1	110	110.0	8.1	8.1
Symphurus atricauda	California tonguefish	-	-	-	-	-	2	80-102	91.0	4.8-10.2	7.5
Syngnathus spp.	pipefishes	97	135-259	196.6	0.4-7.1	2.2	40	137-218	181.6	0.4-3.3	1.6
Torpedo californica	Pacific electric ray	-	-	-	-	-	3	160-205	180.7	259.6-381.5	308.0
unidentified fish, damaged	unidentified damaged fish	1	-	-	-	-	3	-	-	-	-
INVERTEBRATES											
Cancer anthonyi	yellow crab	-	-	-	-	-	1	120	120.0	235.4	235.4
Cancer jordani	hairy rock crab	-	-	-	-	-	2	22-25	23.5	2.6-3.1	2.8
Cancer magister	dungeness crab	-	-	-	-	-	3	23-26	24.3	1.9-2.7	2.4
Cancer productus	red rock crab	-	-	-	-	-	8	66-108	82.7	43.8-145.5	71.0
Cancer spp.	cancer crabs	-	-	-	-	-	1	12	12.0	0.4	0.4
Carcinus maenas	European green crab	-	-	-	-	-	1	72	72.0	88.9	88.9
Crangon franciscorum	Franciscan bay shrimp	1	8	8.0	0.3	0.3	-	-	-	-	-

*Totals for Units 1&2 include bar rack sample totals.

(continued)

Table B-32 continued. Moss Landing Power Plant Impingement Abundance Survey 32, June 21, 2006.

Taxon	Common Name	Units 1&2* Count	Units 1&2* Length Range (mm)	Units 1&2* Length Average (mm)	Units 1&2* Weight Range (g)	Units 1&2* Weight Average (g)	Units 6&7 Count	Units 6&7 Length Range (mm)	Units 6&7 Length Average (mm)	Units 6&7 Weight Range (g)	Units 6&7 Weight Average (g)
INVERTEBRATES (continued)											
Crangon nigromaculata	spotted bay shrimp	-	-	-	-	-	8	8-16	11.9	0.5-3.4	1.8
Crangon spp.	bay shrimp	171	7-15	10.6	0.2-3.0	0.9	530	9-22	12.3	0.5-6.5	1.3
Hemigrapsus oregonensis	yellow shore crab	-	-	-	-	-	5	16-26	19.8	1.9-5.9	3.3
Heptacarpus spp.	tidepool shrimps	2	4-10	7.0	0.3-0.5	0.4	4	8-9	8.5	0.3-0.6	0.4
Loligo opalescens	market squid	-	-	-	-	-	1	146	146.0	10.2	10.2
Pachygrapsus crassipes	striped shore crab	8	16-38	23.0	1.2-21.0	7.0	3	18-27	22.3	3.1-10.4	5.8
Pugettia producta	northern kelp crab	14	10-41	23.9	0.8-26.2	8.6	23	11-32	18.6	0.8-11.8	3.7
Pugettia richii	cryptic kelp crab	1	13	13.0	1.0	1.0	-	-	-	-	-

*Totals for Units 1&2 include bar rack sample totals.

Table B-33. Moss Landing Power Plant Impingement Abundance Survey 33, June 28, 2006.

Taxon	Common Name	Units 1&2* Count	Units 1&2* Length Range (mm)	Units 1&2* Length Average (mm)	Units 1&2* Weight Range (g)	Units 1&2* Weight Average (g)	Units 6&7 Count	Units 6&7 Length Range (mm)	Units 6&7 Length Average (mm)	Units 6&7 Weight Range (g)	Units 6&7 Weight Average (g)
FISHES											
Atherinops affinis	topsmelt	9	39-157	81.3	0.3-37.2	8.3	8	56-205	115.0	1.2-69.0	18.5
Atherinopsidae unid.	silversides	1	42	42.0	0.6	0.6	1	70	70.0	2.2	2.2
Atherinopsis californiensis	jacksmelt	-	-	-	-	-	2	175-200	187.5	47.8-71.2	59.5
Citharichthys sordidus	Pacific sanddab	-	-	-	-	-	1	175	175.0	61.1	61.1
Citharichthys stigmaeus	speckled sanddab	-	-	-	-	-	32	67-88	73.3	4.3-11.4	6.4
Clevelandia ios	arrow goby	1	55	55.0	1.6	1.6	-	-	-	-	-
Clupea pallasii	Pacific herring	-	-	-	-	-	6	110-179	148.5	12.1-55.7	37.3
Cymatogaster aggregata	shiner surfperch	4	85-102	93.5	2.6-22.2	14.8	9	39-122	94.9	1.1-41.5	22.7
Diaphus theta	California headlight fish	2	67	67.0	3.4	3.4	-	-	-	-	-
Engraulis mordax	northern anchovy	3	99-110	103.7	8.3-11.1	9.5	27	97-147	112.9	6.4-23.9	12.0
Gasterosteus aculeatus	threespine stickleback	-	-	-	-	-	8	36-62	47.9	0.5-2.8	1.6
Hyperprosopon argenteum	walleye surfperch	-	-	-	-	-	2	50-52	51.0	2.1-2.5	2.3
Hyperprosopon ellipticum	silver surfperch	-	-	-	-	-	5	47-51	49.2	1.8-2.3	2.0
Hypomesus paetiosus	surf smelt	-	-	-	-	-	1	123	123.0	19.0	19.0
Icichthys lockingtoni	medusa fish	-	-	-	-	-	1	30	30.0	0.4	0.4
Lepidogobius lepidus	bay goby	2	80-89	84.5	5.6-6.9	6.3	14	75-95	87.1	4.5-8.9	6.4
Leptocottus armatus	Pacific staghorn sculpin	7	64-116	83.9	4.3-30.6	11.6	16	55-116	82.7	2.4-27.1	10.0
Micrometrus aurora	reef perch	-	-	-	-	-	1	34	34.0	1.2	1.2
Myctophidae unid.	lanternfishes	1	-	-	-	-	-	-	-	-	-
Parophrys vetulus	English sole	1	71	71.0	6.9	6.9	7	61-84	71.6	2.8-8.9	5.4
Phanerodon furcatus	white surfperch	2	29-30	29.5	0.6	0.6	9	34-52	42.6	0.7-2.7	1.5
Pimephalas promelas	fathead minnow	5	22-32	27.8	0.1-0.6	0.3	1	31	31.0	0.4	0.4
Platichthys stellatus	starry flounder	-	-	-	-	-	3	55-69	63.7	2.5-6.6	4.4
Pleuronichthys verticalis	hornyhead turbot	1	96	96.0	21.3	21.3	-	-	-	-	-
Porichthys notatus	plainfin midshipman	1	129	129.0	28.4	28.4	10	85-162	128.6	5.4-58.2	30.5
Sardinops sagax	Pacific sardine	2	122-128	125.0	16.9-18.1	17.5	4	118-135	126.5	15.1-22.0	18.3
Scorpaenichthys marmoratus	cabezon	6	55-130	69.8	4.4-62.2	14.5	-	-	-	-	-
Stenobrachius leucopsarus	northern lampfish	-	-	-	-	-	1	80	80.0	4.5	4.5
Symphurus atricauda	California tonguefish	1	78	78.0	4.1	4.1	1	-	-	-	-
Syngnathus spp.	pipefishes	14	152-303	204.5	1.5-8.3	3.0	5	113-222	175.0	0.4-3.2	1.7
Torpedo californica	Pacific electric ray	2	170	170.0	216.0-220.0	218.0	7	117-224	186.9	94.4-500.0	354.7
unidentified fish, damaged	unidentified damaged fish	-	-	-	-	-	3	-	-	-	-
INVERTEBRATES											
Cancer jordani	hairy rock crab	1	22	22.0	2.1	2.1	2	12-21	16.5	0.6-3.3	1.9
Cancer magister	dungeness crab	-	-	-	-	-	1	33	33.0	5.9	5.9
Cancer productus	red rock crab	-	-	-	-	-	2	89-97	93.0	95.7-107.8	101.8

*Totals for Units 1&2 include bar rack sample totals.

(continued)

Table B-33 continued. Moss Landing Power Plant Impingement Abundance Survey 33, June 28, 2006.

		Units 1&2*					Units 6&7				
			Length		Weight			Length		Weight	
Taxon	Common Name	Count	Range (mm)	Average	Range (g)	Average	Count	Range (mm)	Average	Range (g)	Average
INVERTEBRATES (continued)											
Crangon nigricauda	black-tailed bay shrimp	2	5	5.0	0.4	0.4	-	-	-	-	-
Crangon nigromaculata	spotted bay shrimp	3	7-12	9.3	0.4-1.9	1.2	12	8-13	10.7	0.5-2.6	1.5
Crangon spp.	bay shrimp	25	5-13	8.0	0.3-2.4	0.7	130	6-16	11.6	0.4-3.2	1.4
Emerita analoga	mole crab	-	-	-	-	-	1	24	24.0	4.6	4.6
Hemigrapsus oregonensis	yellow shore crab	1	10	10.0	0.7	0.7	2	11-22	16.5	0.4-5.9	3.2
Loligo opalescens	market squid	16	162-225	195.4	11.5-59.0	24.8	9	52-180	114.0	0.8-20.0	7.0
Neotrypaea californiensis	ghost bay shrimp	1	13	13.0	1.8	1.8	-	-	-	-	-
Pachygrapsus crassipes	striped shore crab	9	8-26	17.9	0.7-12.1	4.3	6	14-34	23.5	1.0-15.7	6.1
Protothaca spp.	unidentified littleneck clam	1	38	38.0	22.0	22.0	-	-	-	-	-
Pugettia producta	northern kelp crab	11	12-35	21.9	1.3-16.6	6.2	17	5-50	24.6	0.2-41.4	10.3
Pugettia richii	cryptic kelp crab	-	-	-	-	-	1	12	12.0	2.3	2.3

*Totals for Units 1&2 include bar rack sample totals.

Table B-34. Moss Landing Power Plant Impingement Abundance Survey 34, July 6, 2006.

Taxon	Common Name	Units 1&2* Count	Units 1&2* Length Range (mm)	Units 1&2* Length Average (mm)	Units 1&2* Weight Range (g)	Units 1&2* Weight Average (g)	Units 6&7 Count	Units 6&7 Length Range (mm)	Units 6&7 Length Average (mm)	Units 6&7 Weight Range (g)	Units 6&7 Weight Average (g)
FISHES											
Artedius lateralis							1	39	39.0	1.3	1.3
Atherinops affinis	topsmelt	1	102	102.0	9.7	9.7	9	67-135	102.4	2.5-19.9	10.3
Citharichthys stigmaeus	speckled sanddab	-	-	-	-	-	83	52-93	73.9	1.9-12.3	7.1
Clevelandia ios	arrow goby	1	43	43.0	0.7	0.7	2	42-83	62.5	0.5-7.1	3.8
Clupea pallasii	Pacific herring	-	-	-	-	-	4	66-162	112.5	2.9-52.4	25.2
Cymatogaster aggregata	shiner surfperch	2	34	34.0	0.7	0.7	11	33-101	55.6	0.7-29.8	8.2
Cyprinidae unid.	minnows and carps	-	-	-	-	-	1	-	-	-	-
Diaphus theta	California headlight fish	1	66	66.0	3.0	3.0	-	-	-	-	-
Embiotocidae unid.	surfperches	-	-	-	-	-	3	33-38	35.3	0.8-1.2	1.0
Engraulis mordax	northern anchovy	1	-	-	-	-	22	82-109	95.4	0.3-10.5	6.2
Gasterosteus aculeatus	threespine stickleback	-	-	-	-	-	2	42-56	49.0	1.2-3.0	2.1
Hyperprosopon anale	spotfin surfperch	-	-	-	-	-	1	109	109.0	21.2	21.2
Hyperprosopon argenteum	walleye surfperch	1	-	-	-	-	3	49-57	53.0	2.5-4.2	3.1
Hyperprosopon ellipticum	silver surfperch	-	-	-	-	-	1	49	49.0	2.5	2.5
Lepidogobius lepidus	bay goby	-	-	-	-	-	14	76-95	85.4	4.8-8.3	6.3
Leptocottus armatus	Pacific staghorn sculpin	2	94	94.0	15.9	15.9	95	40-132	88.2	1.0-42.8	14.6
Micrometrus minimus	dwarf surfperch	1	55	55.0	4.9	4.9	-	-	-	-	-
Myctophidae unid.	lanternfishes	1	59	59.0	2.3	2.3	-	-	-	-	-
Myliobatis californica	bat ray	-	-	-	-	-	1	350	350.0	625.0	625.0
Oncorhynchus tshawytscha	Chinook salmon	-	-	-	-	-	2	89	89.0	7.2	7.2
Parophrys vetulus	English sole	-	-	-	-	-	53	52-106	79.2	1.2-24.8	8.3
Phanerodon furcatus	white surfperch	1	60	60.0	2.3	2.3	11	35-129	54.6	0.9-52.5	6.8
Platichthys stellatus	starry flounder	2	63-85	74.0	4.2-11.0	7.6	18	50-172	81.1	2.5-108.6	14.3
Platyrhinoidis triseriata	thornback	-	-	-	-	-	1	336	336.0	2,325.0	2,325.0
Porichthys notatus	plainfin midshipman	-	-	-	-	-	25	85-164	129.4	8.1-58.3	29.4
Sardinops sagax	Pacific sardine	1	-	-	-	-	4	95-135	118.0	6.5-18.5	13.5
Scorpaenichthys marmoratus	cabezon	3	49-136	98.7	2.9-63.9	34.2	5	49-153	94.0	3.3-85.4	32.1
Symphurus atricauda	California tonguefish	-	-	-	-	-	1	80	80.0	4.5	4.5
Syngnathus spp.	pipefishes	28	98-234	189.1	0.2-4.6	1.9	9	86-216	176.1	0.2-3.1	1.5
Torpedo californica	Pacific electric ray	-	-	-	-	-	1	156	156.0	169.6	169.6
unidentified fish, damaged	unidentified damaged fish	-	-	-	-	-	1	-	-	-	-
INVERTEBRATES											
Cancer antennarius	brown rock crab	1	68	68.0	77.1	77.1	1	90	90.0	110.5	110.5
Cancer gracilis	slender crab	-	-	-	-	-	2	33-79	56.0	7.6-101.7	54.6
Cancer jordani	hairy rock crab	4	16-23	19.3	1.6-3.3	2.3	1	22	22.0	2.4	2.4
Cancer magister	dungeness crab	2	17-28	22.5	1.0-3.6	2.3	9	30-35	32.2	4.5-8.0	5.7
Cancer productus	red rock crab	1	13	13.0	0.4	0.4	3	82-100	89.3	80.2-143.9	102.8

*Totals for Units 1&2 include bar rack sample totals.

(continued)

Table B-34 continued. Moss Landing Power Plant Impingement Abundance Survey 34, July 6, 2006.

Taxon	Common Name	Units 1&2* Count	Units 1&2* Length Range (mm)	Units 1&2* Length Average (mm)	Units 1&2* Weight Range (g)	Units 1&2* Weight Average (g)	Units 6&7 Count	Units 6&7 Length Range (mm)	Units 6&7 Length Average (mm)	Units 6&7 Weight Range (g)	Units 6&7 Weight Average (g)
INVERTEBRATES (continued)											
Cancer spp.	cancer crabs	1	19	19.0	2.1	2.1	-	-	-	-	-
Crangon franciscorum	Franciscan bay shrimp	1	6	6.0	0.2	0.2	1	11	11.0	1.3	1.3
Crangon nigromaculata	spotted bay shrimp	4	6-12	8.8	0.4-2.6	1.5	-	-	-	-	-
Crangon spp.	bay shrimp	156	6-15	9.6	0.2-13.6	0.8	357	7-28	12.0	0.4-5.2	1.2
Heptacarpus spp.	tidepool shrimps	3	6-8	7.3	0.4-0.9	0.6	1	6	6.0	0.2	0.2
Loligo opalescens	market squid	1	-	-	-	-	-	-	-	-	-
Pachycheles rudis	thickclaw porcelain crab	1	13	13.0	2.0	2.0	-	-	-	-	-
Pachygrapsus crassipes	striped shore crab	7	7-30	20.0	0.5-11.9	5.7	1	10	10.0	0.3	0.3
Pandalus danae		-	-	-	-	-	2	16-19	17.5	3.8-4.6	4.2
Pugettia producta	northern kelp crab	16	13-48	23.1	1.1-58.7	9.4	4	13-22	16.5	1.5-7.6	3.9

*Totals for Units 1&2 include bar rack sample totals.

Table B-35. Moss Landing Power Plant Impingement Abundance Survey 35, July 12, 2006.

Taxon	Common Name	Units 1&2* Count	Units 1&2* Length Range (mm)	Units 1&2* Length Average (mm)	Units 1&2* Weight Range (g)	Units 1&2* Weight Average (g)	Units 6&7 Count	Units 6&7 Length Range (mm)	Units 6&7 Length Average (mm)	Units 6&7 Weight Range (g)	Units 6&7 Weight Average (g)
FISHES											
Atherinops affinis	topsmelt	-	-	-	-	-	7	87-118	101.0	2.9-13.7	7.8
Citharichthys stigmaeus	speckled sanddab	-	-	-	-	-	8	76-92	82.9	5.5-10.9	7.7
Cymatogaster aggregata	shiner surfperch	2	35-102	68.5	0.7-22.7	11.7	19	36-119	66.6	0.2-24.7	8.5
Cyprinus carpio	common carp	1	37	37.0	1.1	1.1	-	-	-	-	-
Engraulis mordax	northern anchovy	2	104	104.0	9.8	9.8	17	90-125	100.0	4.8-8.6	6.9
Gasterosteus aculeatus	threespine stickleback	1	49	49.0	1.4	1.4	2	41-45	43.0	0.8-0.9	0.8
Gibbonsia montereyensis	crevice kelpfish	1	114	114.0	13.7	13.7	-	-	-	-	-
Hyperprosopon argenteum	walleye surfperch	-	-	-	-	-	6	45-66	53.0	1.6-2.7	2.2
Hyperprosopon ellipticum	silver surfperch	-	-	-	-	-	2	51-55	53.0	2.2-3.1	2.6
Lepidogobius lepidus	bay goby	1	115	115.0	8.2	8.2	-	-	-	-	-
Leptocottus armatus	Pacific staghorn sculpin	4	72-109	87.8	3.9-12.9	8.8	7	58-130	94.3	3.1-20.2	11.0
Micrometrus minimus	dwarf surfperch	-	-	-	-	-	1	74	74.0	10.2	10.2
Oncorhynchus tshawytscha	Chinook salmon	-	-	-	-	-	1	100	100.0	6.9	6.9
Parophrys vetulus	English sole	-	-	-	-	-	4	67-102	79.3	3.3-15.3	6.8
Phanerodon atripes	sharpnose seaperch	-	-	-	-	-	1	57	57.0	3.2	3.2
Phanerodon furcatus	white surfperch	1	32	32.0	0.6	0.6	14	35-71	52.9	0.8-3.7	2.6
Pimephalas promelas	fathead minnow	4	29-39	35.0	0.3-0.8	0.5	-	-	-	-	-
Platichthys stellatus	starry flounder	-	-	-	-	-	6	72-86	81.5	5.2-10.3	8.5
Sardinops sagax	Pacific sardine	-	-	-	-	-	1	-	-	-	-
Scomber japonicus	Pacific mackerel	1	227	227.0	147.4	147.4	1	209	209.0	85.3	85.3
Scorpaenichthys marmoratus	cabezon	7	36-139	72.7	1.0-60.9	13.1	-	-	-	-	-
Syngnathus spp.	pipefishes	18	156-258	199.7	0.7-4.7	2.0	-	-	-	-	-
Torpedo californica	Pacific electric ray	-	-	-	-	-	2	190-220	205.0	326.5-420.0	373.3
INVERTEBRATES											
Cancer jordani	hairy rock crab	2	18-33	25.5	1.5-8.8	5.2	-	-	-	-	-
Cancer magister	dungeness crab	3	26-27	26.7	3.0-3.8	3.4	5	33-37	34.6	5.8-8.6	6.9
Cancer productus	red rock crab	1	30	30.0	3.9	3.9	6	77-110	91.3	59.7-195.4	98.6
Crangon franciscorum	Franciscan bay shrimp	1	8	8.0	0.4	0.4	-	-	-	-	-
Crangon nigricauda	black-tailed bay shrimp	17	5-12	9.4	0.3-1.5	0.6	5	7-11	9.4	0.4-1.1	0.8
Crangon nigromaculata	spotted bay shrimp	7	8-18	12.1	0.4-3.0	1.3	7	9-14	10.6	0.7-4.2	1.9
Grapsidae unid.	shore crabs	-	-	-	-	-	1	-	-	-	-
Hemigrapsus oregonensis	yellow shore crab	2	13-18	15.5	0.9-1.2	1.1	1	6	6.0	0.3	0.3
Heptacarpus spp.	tidepool shrimps	1	7	7.0	0.6	0.6	-	-	-	-	-
Loxorhynchus crispatus	moss crab	1	42	42.0	72.7	72.7	-	-	-	-	-
Pachygrapsus crassipes	striped shore crab	2	10-25	17.5	0.3-9.2	4.7	1	32	32.0	11.4	11.4
Protothaca staminea	Pacific littleneck	1	14	14.0	1.1	1.1	-	-	-	-	-
Pugettia producta	northern kelp crab	4	14-32	23.8	1.7-18.4	8.3	6	24-48	33.2	6.0-40.0	18.0

*Totals for Units 1&2 include bar rack sample totals.

Table B-36. Moss Landing Power Plant Impingement Abundance Survey 36, July 19, 2006.

Taxon	Common Name	Units 1&2* Count	Units 1&2* Length Range (mm)	Units 1&2* Length Average (mm)	Units 1&2* Weight Range (g)	Units 1&2* Weight Average (g)	Units 6&7 Count	Units 6&7 Length Range (mm)	Units 6&7 Length Average (mm)	Units 6&7 Weight Range (g)	Units 6&7 Weight Average (g)
FISHES											
Anoplopoma fimbria	sablefish	-	-	-	-	-	1	460	460.0	1,250.0	1,250.0
Atherinops affinis	topsmelt	2	57-67	62.0	1.4-2.0	1.7	5	85-164	121.3	4.6-39.3	19.4
Carassius auratus	goldfish	1	36	36.0	1.1	1.1	-	-	-	-	-
Citharichthys stigmaeus	speckled sanddab	-	-	-	-	-	50	63-90	77.6	4.2-10.9	8.3
Clevelandia ios	arrow goby	2	40-41	40.5	0.4-0.5	0.5	-	-	-	-	-
Cymatogaster aggregata	shiner surfperch	-	-	-	-	-	12	38-109	70.8	0.8-32.0	11.4
Cyprinidae unid.	minnows and carps	1	43	43.0	2.1	2.1	-	-	-	-	-
Engraulis mordax	northern anchovy	-	-	-	-	-	13	83-117	103.3	4.9-14.2	10.0
Gasterosteus aculeatus	threespine stickleback	3	24-47	36.0	0.1-1.4	0.7	4	45-63	52.0	1.6-16.0	5.6
Hyperprosopon argenteum	walleye surfperch	-	-	-	-	-	6	49-64	57.3	3.0-6.1	4.5
Hypsopsetta guttulata	diamond turbot	1	50	50.0	2.4	2.4	-	-	-	-	-
Lepidogobius lepidus	bay goby	3	82-85	83.7	5.8-6.4	6.2	14	72-90	84.4	4.4-8.3	6.8
Leptocottus armatus	Pacific staghorn sculpin	1	82	82.0	8.4	8.4	19	53-101	83.3	2.1-19.6	10.5
Parmaturus xaniurus	filetail cat shark	1	400	400.0	318.4	318.4	-	-	-	-	-
Parophrys vetulus	English sole	-	-	-	-	-	60	56-109	87.4	2.5-18.1	10.4
Peprilus simillimus	Pacific butterfish	-	-	-	-	-	1	101	101.0	18.6	18.6
Phanerodon atripes	sharpnose seaperch	-	-	-	-	-	2	31-52	41.5	0.9-3.1	2.0
Phanerodon furcatus	white surfperch	2	35	35.0	0.7	0.7	8	36-110	58.1	0.8-26.9	5.5
Pimephalas promelas	fathead minnow	1	38	38.0	0.7	0.7	-	-	-	-	-
Platichthys stellatus	starry flounder	4	44-88	72.5	1.6-11.5	7.6	3	73-88	80.0	6.1-10.6	8.7
Porichthys notatus	plainfin midshipman	2	119-130	124.5	24.1-29.8	26.9	23	48-170	88.2	1.2-59.8	15.9
Scorpaenichthys marmoratus	cabezon	1	91	91.0	16.6	16.6	-	-	-	-	-
Symphurus atricauda	California tonguefish	3	75-87	79.7	3.4-6.8	4.8	1	98	98.0	8.7	8.7
Syngnathus spp.	pipefishes	10	183-227	199.4	1.5-6.3	3.0	2	214-254	234.0	4.0-6.6	5.3
Torpedo californica	Pacific electric ray	3	140-177	155.7	150.7-273.0	201.7	9	130-187	162.2	99.4-304.0	207.6
INVERTEBRATES											
Cancer magister	dungeness crab	2	32-45	38.5	6.8-14.1	10.5	6	24-51	39.5	2.3-18.7	11.2
Cancer productus	red rock crab	1	18	18.0	0.9	0.9	6	85-110	95.8	76.9-209.3	127.8
Cancer spp.	cancer crabs	1	18	18.0	1.6	1.6	1	20	20.0	1.7	1.7
Crangon alaskensis	northern crangon	1	15	15.0	3.2	3.2	-	-	-	-	-
Crangon nigromaculata	spotted bay shrimp	6	7-10	8.2	0.4-0.8	0.6	1	9	9.0	0.5	0.5
Crangon spp.	bay shrimp	213	4-12	6.3	0.2-2.1	0.6	424	7-15	9.7	0.3-4.0	1.1
Hemigrapsus oregonensis	yellow shore crab	1	13	13.0	0.8	0.8	-	-	-	-	-
Heptacarpus spp.	tidepool shrimps	-	-	-	-	-	1	9	9.0	0.4	0.4

*Totals for Units 1&2 include bar rack sample totals.

(continued)

Table B-36 continued. Moss Landing Power Plant Impingement Abundance Survey 36, July 19, 2006.

Taxon	Common Name	Units 1&2* Count	Units 1&2* Length Range (mm)	Units 1&2* Length Average (mm)	Units 1&2* Weight Range (g)	Units 1&2* Weight Average (g)	Units 6&7 Count	Units 6&7 Length Range (mm)	Units 6&7 Length Average (mm)	Units 6&7 Weight Range (g)	Units 6&7 Weight Average (g)
INVERTEBRATES (continued)											
Octopus rubescens	East Pacific red octopus	-	-	-	-	-	1	425	425.0	126.6	126.6
Pachygrapsus crassipes	striped shore crab	3	17-20	19.0	2.2-6.4	3.9	-	-	-	-	-
Protothaca staminea	Pacific littleneck	1	34	34.0	12.5	12.5	-	-	-	-	-
Pugettia producta	northern kelp crab	30	10-40	23.5	0.5-39.0	8.5	7	18-45	30.7	3.1-56.6	18.5
Pugettia richii	cryptic kelp crab	2	17-22	19.5	2.4-6.1	4.3	-	-	-	-	-

*Totals for Units 1&2 include bar rack sample totals.

Table B-37. Moss Landing Power Plant Impingement Abundance Survey 37, July 26, 2006.

Taxon	Common Name	Units 1&2* Count	Units 1&2* Length Range (mm)	Units 1&2* Length Average (mm)	Units 1&2* Weight Range (g)	Units 1&2* Weight Average (g)	Units 6&7 Count	Units 6&7 Length Range (mm)	Units 6&7 Length Average (mm)	Units 6&7 Weight Range (g)	Units 6&7 Weight Average (g)
FISHES											
Anoplopoma fimbria	sablefish	-	-	-	-	-	4	-	-	-	-
Artedius harringtoni	scalyhead sculpin	-	-	-	-	-	1	74	74.0	10.4	10.4
Artedius notospilotus	bonyhead sculpin	1	40	40.0	1.4	1.4	-	-	-	-	-
Atherinops affinis	topsmelt	5	67-127	85.4	2.6-20.5	7.2	9	70-98	79.3	2.7-7.0	4.5
Atherinopsis californiensis	jacksmelt	1	254	254.0	182.1	182.1	-	-	-	-	-
Citharichthys sordidus	Pacific sanddab	-	-	-	-	-	1	114	114.0	19.9	19.9
Citharichthys stigmaeus	speckled sanddab	1	72	72.0	6.2	6.2	25	68-92	79.0	5.0-13.5	8.3
Clupea pallasii	Pacific herring	-	-	-	-	-	4	41-46	44.0	0.7-1.1	0.9
Cottus asper	prickly sculpin	-	-	-	-	-	1	132	132.0	46.8	46.8
Cymatogaster aggregata	shiner surfperch	2	36-94	65.0	0.9-19.5	10.2	28	32-99	66.2	0.7-23.3	10.3
Embiotocidae unid. (juv.)	juvenile surfperches	1	30	30.0	0.5	0.5	-	-	-	-	-
Engraulis mordax	northern anchovy	2	102-106	104.0	9.8-10.9	10.3	273	36-122	102.7	0.2-14.7	8.5
Gasterosteus aculeatus	threespine stickleback	5	21-40	33.0	0.1-0.8	0.5	18	29-57	44.9	0.3-3.7	1.4
Hyperprosopon argenteum	walleye surfperch	-	-	-	-	-	3	53-63	58.0	3.1-6.1	4.4
Lepidogobius lepidus	bay goby	1	83	83.0	5.5	5.5	1	89	89.0	6.5	6.5
Leptocottus armatus	Pacific staghorn sculpin	5	72-99	88.0	6.0-15.3	11.6	48	57-118	84.1	3.4-29.9	11.2
Parophrys vetulus	English sole	-	-	-	-	-	25	53-102	83.5	3.0-16.0	9.2
Peprilus simillimus	Pacific butterfish	-	-	-	-	-	3	39-102	80.3	0.8-21.2	13.5
Phanerodon furcatus	white surfperch	1	36	36.0	0.7	0.7	11	36-60	51.5	0.8-3.9	2.8
Pholis ornata	saddleback gunnel	1	87	87.0	2.3	2.3	-	-	-	-	-
Pimephalas promelas	fathead minnow	1	26	26.0	0.3	0.3	-	-	-	-	-
Porichthys notatus	plainfin midshipman	1	123	123.0	27.4	27.4	4	61-105	81.0	4.0-22.2	11.4
Porichthys notatus		-	-	-	-	-	9	45-145	75.7	1.3-40.7	10.6
Scorpaenichthys marmoratus	cabezon	1	84	84.0	13.8	13.8	1	95	95.0	21.7	21.7
Spirinchus starksi	night smelt	-	-	-	-	-	2	99-109	104.0	5.8-8.4	7.1
Symphurus atricauda	California tonguefish	1	112	112.0	12.2	12.2	-	-	-	-	-
Syngnathus spp.	pipefishes	6	133-235	194.7	0.5-3.8	1.9	1	136	136.0	0.7	0.7
Torpedo californica	Pacific electric ray	2	149-185	167.0	128.2-215.9	172.0	1	161	161.0	212.7	212.7
INVERTEBRATES											
Cancer antennarius	brown rock crab	-	-	-	-	-	1	19	19.0	1.4	1.4
Cancer jordani	hairy rock crab	4	17-36	25.5	2.1-11.1	5.5	1	19	19.0	2.8	2.8
Cancer magister	dungeness crab	3	23-31	28.3	1.9-4.2	3.3	4	31-36	34.0	4.4-6.9	5.9
Cancer productus	red rock crab	-	-	-	-	-	2	84-120	102.0	97.7-315.7	206.7
Cancer spp.	cancer crabs	1	24	24.0	2.7	2.7	-	-	-	-	-
Chionoecetes tanneri	grooved tanner crab	1	133	133.0	425.0	425.0	-	-	-	-	-

*Totals for Units 1&2 include bar rack sample totals.

(continued)

Table B-37 continued. Moss Landing Power Plant Impingement Abundance Survey 37, July 26, 2006.

Taxon	Common Name	Units 1&2* Count	Units 1&2* Length Range (mm)	Units 1&2* Length Average (mm)	Units 1&2* Weight Range (g)	Units 1&2* Weight Average (g)	Units 6&7 Count	Units 6&7 Length Range (mm)	Units 6&7 Length Average (mm)	Units 6&7 Weight Range (g)	Units 6&7 Weight Average (g)
INVERTEBRATES (continued)											
Crangon alaskensis	northern crangon	2	11-13	12.0	1.2-1.7	1.5	-	-	-	-	-
Crangon franciscorum	Franciscan bay shrimp	2	10	10.0	0.7-0.8	0.8	-	-	-	-	-
Crangon nigricauda	black-tailed bay shrimp	9	5-13	9.1	0.3-2.1	1.1	-	-	-	-	-
Crangon nigromaculata	spotted bay shrimp	1	4	4.0	0.1	0.1	1	6	6.0	0.4	0.4
Crangon spp.	bay shrimp	161	5-13	9.4	0.3-2.9	0.9	469	6-16	10.7	0.3-4.1	1.0
Hemigrapsus nudus	purple shore crab	1	31	31.0	8.6	8.6	-	-	-	-	-
Hemigrapsus oregonensis	yellow shore crab	1	16	16.0	2.9	2.9	2	15-20	17.5	1.2-5.0	3.1
Loligo opalescens	market squid	1	166	166.0	13.1	13.1	4	62-128	84.5	0.8-4.4	1.8
Lophopanopeus bellus	black-claw crestleg crab	1	15	15.0	1.7	1.7	-	-	-	-	-
Pachygrapsus crassipes	striped shore crab	9	12-41	20.7	0.9-15.1	4.7	2	9-30	19.5	0.6-15.0	7.8
Panulirus interruptus	California spiny lobster	1	8	8.0	0.1	0.1	-	-	-	-	-
Pelia tumida	dwarf teardrop crab	1	11	11.0	0.9	0.9	-	-	-	-	-
Pugettia producta	northern kelp crab	14	11-58	33.2	0.7-79.0	22.4	18	16-49	29.4	1.8-54.4	18.3
Pugettia richii	cryptic kelp crab	1	19	19.0	2.6	2.6	1	11	11.0	1.5	1.5
Pugettia spp.	kelp crabs	-	-	-	-	-	1	3	3.0	0.1	0.1

*Totals for Units 1&2 include bar rack sample totals.

Table B-38. Moss Landing Power Plant Impingement Abundance Survey 38, August 2, 2006.

Taxon	Common Name	Units 1&2* Count	Units 1&2* Length Range (mm)	Units 1&2* Length Average (mm)	Units 1&2* Weight Range (g)	Units 1&2* Weight Average (g)	Units 6&7 Count	Units 6&7 Length Range (mm)	Units 6&7 Length Average (mm)	Units 6&7 Weight Range (g)	Units 6&7 Weight Average (g)
FISHES											
Artedius lateralis	smoothhead sculpin	1	55	55.0	3.2	3.2	-	-	-	-	-
Artedius notospilotus	bonyhead sculpin	-	-	-	-	-	1	79	79.0	11.1	11.1
Atherinops affinis	topsmelt	12	59-126	76.1	1.5-19.2	4.5	111	56-150	98.1	1.3-30.8	8.7
Atherinopsis californiensis	jacksmelt	-	-	-	-	-	1	235	235.0	117.1	117.1
Citharichthys stigmaeus	speckled sanddab	1	75	75.0	6.0	6.0	32	58-91	77.4	3.1-12.4	8.4
Clupea pallasii	Pacific herring	-	-	-	-	-	9	49-103	65.5	0.9-12.9	3.8
Cymatogaster aggregata	shiner surfperch	4	38-103	58.3	1.0-16.3	5.3	73	36-100	53.1	0.9-24.7	4.7
Engraulis mordax	northern anchovy	-	-	-	-	-	293	41-133	98.4	0.4-17.0	7.4
Gasterosteus aculeatus	threespine stickleback	2	30-43	36.5	0.2-0.8	0.5	9	39-70	49.2	0.6-3.6	1.5
Hyperprosopon argenteum	walleye surfperch	-	-	-	-	-	4	50-66	56.5	2.2-7.2	4.4
Hyperprosopon ellipticum	silver surfperch	-	-	-	-	-	2	31-50	40.5	0.5-2.0	1.3
Lepidogobius lepidus	bay goby	2	91-93	92.0	5.6-9.2	7.4	13	74-92	83.5	4.6-8.3	6.2
Leptocottus armatus	Pacific staghorn sculpin	7	73-121	91.4	8.7-24.6	13.7	39	69-120	92.8	5.0-27.3	14.0
Oncorhynchus tshawytscha	Chinook salmon	-	-	-	-	-	2	111-113	112.0	12.2-15.9	14.0
Parophrys vetulus	English sole	-	-	-	-	-	35	73-111	94.1	5.8-21.4	12.1
Peprilus simillimus	Pacific butterfish	-	-	-	-	-	2	30-33	31.5	0.5-0.7	0.6
Phanerodon furcatus	white surfperch	1	70	70.0	7.8	7.8	12	35-60	50.3	0.7-3.5	2.3
Platichthys stellatus	starry flounder	1	91	91.0	15.4	15.4	3	59-235	123.7	3.6-375.0	128.2
Platyrhinoidis triseriata	thornback	-	-	-	-	-	2	275-335	305.0	1,000.0-1,900.0	1,450.0
Porichthys notatus	plainfin midshipman	-	-	-	-	-	34	46-141	77.4	1.1-38.0	9.5
Sardinops sagax	Pacific sardine	-	-	-	-	-	3	75-113	89.3	4.5-9.7	6.3
Scomber japonicus	Pacific mackerel	-	-	-	-	-	1	218	218.0	118.1	118.1
Scorpaenichthys marmoratus	cabezon	2	55-95	75.0	3.8-19.8	11.8	1	85	85.0	15.2	15.2
Spirinchus starksi	night smelt	-	-	-	-	-	1	105	105.0	9.4	9.4
Symphurus atricauda	California tonguefish	-	-	-	-	-	5	52-86	76.2	3.9-6.5	4.8
Syngnathus spp.	pipefishes	5	104-164	136.0	0.4-1.6	1.0	5	66-235	168.6	1.5-6.0	3.0
Torpedo californica	Pacific electric ray	1	150	150.0	147.9	147.9	1	200	200.0	333.9	333.9
INVERTEBRATES											
Cancer gracilis	slender crab	1	76	76.0	87.6	87.6	1	83	83.0	109.5	109.5
Cancer jordani	hairy rock crab	1	16	16.0	1.1	1.1	3	19-32	23.3	1.7-8.6	4.3
Cancer magister	dungeness crab	-	-	-	-	-	7	30-44	35.7	4.3-11.4	6.8
Cancer productus	red rock crab	2	33-86	59.5	6.5-104.5	55.5	3	59-90	79.7	40.4-99.0	73.8
Cancer spp.	cancer crabs	2	8-9	8.5	0.2-0.3	0.3	-	-	-	-	-
Crangon nigricauda	black-tailed bay shrimp	2	10-11	10.5	1.2-2.3	1.8	-	-	-	-	-

*Totals for Units 1&2 include bar rack sample totals.

(continued)

Table B-38 continued. Moss Landing Power Plant Impingement Abundance Survey 38, August 2, 2006.

Taxon	Common Name	Units 1&2* Count	Units 1&2* Length Range (mm)	Units 1&2* Length Average (mm)	Units 1&2* Weight Range (g)	Units 1&2* Weight Average (g)	Units 6&7 Count	Units 6&7 Length Range (mm)	Units 6&7 Length Average (mm)	Units 6&7 Weight Range (g)	Units 6&7 Weight Average (g)
INVERTEBRATES (continued)											
Crangon spp.	bay shrimp	79	6-12	9.0	0.3-2.3	0.9	594	6-17	10.9	0.4-4.3	1.2
Hemigrapsus nudus	purple shore crab	1	21	21.0	4.7	4.7	-	-	-	-	-
Hemigrapsus oregonensis	yellow shore crab	1	16	16.0	1.7	1.7	1	24	24.0	6.6	6.6
Heptacarpus spp.	tidepool shrimps	-	-	-	-	-	1	9	9.0	0.6	0.6
Lophopanopeus bellus	black-claw crestleg crab	2	12-18	15.0	0.6-2.7	1.7	-	-	-	-	-
Pachygrapsus crassipes	striped shore crab	1	14	14.0	2.9	2.9	2	20-23	21.5	2.4-7.5	5.0
Protothaca staminea	Pacific littleneck	1	31	31.0	11.9	11.9	-	-	-	-	-
Pugettia producta	northern kelp crab	5	19-44	33.0	4.7-28.1	18.2	15	8-68	31.4	0.2-116.9	19.9

*Totals for Units 1&2 include bar rack sample totals.

Table B-39. Moss Landing Power Plant Impingement Abundance Survey 39, August 9, 2006.

Taxon	Common Name	Units 1&2* Count	Units 1&2* Length Range (mm)	Units 1&2* Length Average (mm)	Units 1&2* Weight Range (g)	Units 1&2* Weight Average (g)	Units 6&7 Count	Units 6&7 Length Range (mm)	Units 6&7 Length Average (mm)	Units 6&7 Weight Range (g)	Units 6&7 Weight Average (g)
FISHES											
Artedius harringtoni	scalyhead sculpin	1	81	81.0	12.7	12.7	-	-	-	-	-
Atherinops affinis	topsmelt	17	35-106	63.3	0.2-12.0	2.8	188	58-148	82.4	1.6-27.4	15.0
Citharichthys stigmaeus	speckled sanddab	1	65	65.0	5.3	5.3	17	68-113	80.7	5.3-25.1	10.3
Clevelandia ios	arrow goby	3	64-72	67.3	3.9-5.4	4.6	2	61-71	66.0	3.1-4.9	4.0
Clupea pallasii	Pacific herring	-	-	-	-	-	10	49-115	68.0	1.2-12.6	4.0
Cymatogaster aggregata	shiner surfperch	5	41-90	75.2	1.6-21.1	13.3	47	31-103	48.0	0.7-25.6	4.3
Engraulis mordax	northern anchovy	2	95	95.0	7.4	7.4	38	87-115	97.9	4.8-13.0	8.0
Gasterosteus aculeatus	threespine stickleback	2	31-34	32.5	0.3-0.6	0.5	21	28-64	43.5	0.3-2.6	1.1
Gillichthys mirabilis	longjaw mudsucker	-	-	-	-	-	1	126	126.0	31.7	31.7
Hyperprosopon argenteum	walleye surfperch	-	-	-	-	-	2	59-67	63.0	4.8-7.7	6.3
Lepidogobius lepidus	bay goby	5	80-90	85.2	5.8-7.0	6.5	4	83-88	84.8	5.1-6.9	6.0
Leptocottus armatus	Pacific staghorn sculpin	12	88-118	100.0	11.9-22.4	17.2	43	54-127	91.5	2.3-35.7	14.4
Micrometrus minimus	dwarf surfperch	-	-	-	-	-	1	90	90.0	18.3	18.3
Myliobatis californica	bat ray	1	293	293.0	284.3	284.3	-	-	-	-	-
Odontopyxis trispinosa	pygmy poacher	1	78	78.0	2.2	2.2	-	-	-	-	-
Parophrys vetulus	English sole	1	80	80.0	9.6	9.6	7	85-111	94.7	11.0-18.9	13.5
Phanerodon atripes	sharpnose seaperch	-	-	-	-	-	1	58	58.0	5.3	5.3
Phanerodon furcatus	white surfperch	-	-	-	-	-	9	31-95	45.0	0.8-19.9	3.6
Platichthys stellatus	starry flounder	-	-	-	-	-	3	94-103	100.0	18.5-22.5	20.6
Porichthys notatus	plainfin midshipman	1	95	95.0	9.6	9.6	34	47-102	63.1	1.0-14.9	4.3
Scorpaenichthys marmoratus	cabezon	6	51-140	101.0	3.5-64.9	31.4	2	88-182	135.0	17.9-170.0	93.9
Spirinchus starksi	night smelt	-	-	-	-	-	2	108-116	112.0	8.7-10.0	9.3
Symphurus atricauda	California tonguefish	1	97	97.0	7.3	7.3	7	79-103	90.3	4.6-11.2	6.7
Syngnathus spp.	pipefishes	14	117-271	207.3	0.3-5.3	2.8	7	100-222	170.6	0.4-4.1	2.0
Torpedo californica	Pacific electric ray	-	-	-	-	-	1	182	182.0	226.1	226.1
unidentified fish, damaged	unidentified damaged fish	-	-	-	-	-	1	-	-	-	-
INVERTEBRATES											
Cancer antennarius	brown rock crab	4	28-88	48.5	5.5-85.8	31.1	2	30-33	31.5	7.2-8.5	7.8
Cancer jordani	hairy rock crab	5	10-32	19.4	0.1-9.1	3.6	1	29	29.0	8.2	8.2
Cancer magister	dungeness crab	1	28	28.0	4.7	4.7	14	23-64	43.5	3.0-29.7	14.2
Cancer productus	red rock crab	-	-	-	-	-	4	56-101	80.0	22.1-120.7	77.0
Crangon nigricauda	black-tailed bay shrimp	4	7-11	8.8	1.7-2.3	2.0	20	4-12	7.0	0.5-2.3	1.1

*Totals for Units 1&2 include bar rack sample totals.

(continued)

Table B-39 continued. Moss Landing Power Plant Impingement Abundance Survey 39, August 9, 2006.

Taxon	Common Name	Units 1&2* Count	Units 1&2* Length Range (mm)	Units 1&2* Length Average (mm)	Units 1&2* Weight Range (g)	Units 1&2* Weight Average (g)	Units 6&7 Count	Units 6&7 Length Range (mm)	Units 6&7 Length Average (mm)	Units 6&7 Weight Range (g)	Units 6&7 Weight Average (g)
INVERTEBRATES (continued)											
Crangon nigromaculata	spotted bay shrimp	4	4-9	6.8	0.1-1.2	0.6	8	5-9	6.1	0.6-1.2	0.8
Crangon spp.	bay shrimp	205	4-13	8.4	0.2-2.9	1.2	272	5-15	9.8	0.4-3.9	1.4
Grapsidae unid.	shore crabs	-	-	-	-	-	1	19	19.0	1.9	1.9
Hemigrapsus oregonensis	yellow shore crab	-	-	-	-	-	2	21-29	25.0	7.4-10.4	8.9
Pachygrapsus crassipes	striped shore crab	5	16-31	22.4	2.4-9.0	4.9	1	27	27.0	9.5	9.5
Pandalopsis dispar	sidestriped shrimp	-	-	-	-	-	1	37	37.0	39.0	39.0
Pugettia producta	northern kelp crab	12	8-49	27.5	0.5-55.2	16.4	18	8-47	29.1	0.5-77.7	20.6
Pugettia richii	cryptic kelp crab	1	10	10.0	1.7	1.7	-	-	-	-	-

*Totals for Units 1&2 include bar rack sample totals.

Table B-40. Moss Landing Power Plant Impingement Abundance Survey 40, August 16, 2006.

Taxon	Common Name	Units 1&2* Count	Units 1&2* Length Range (mm)	Units 1&2* Length Average (mm)	Units 1&2* Weight Range (g)	Units 1&2* Weight Average (g)	Units 6&7 Count	Units 6&7 Length Range (mm)	Units 6&7 Length Average (mm)	Units 6&7 Weight Range (g)	Units 6&7 Weight Average (g)
FISHES											
Acanthogobius flavimanus	yellowfin goby	-	-	-	-	-	1	85	85.0	8.8	8.8
Artedius lateralis	smoothhead sculpin	1	52	52.0	2.5	2.5	-	-	-	-	-
Atherinops affinis	topsmelt	10	50-84	68.4	0.9-5.5	3.1	423	59-161	87.2	1.5-49.2	7.0
Citharichthys stigmaeus	speckled sanddab	1	77	77.0	7.7	7.7	4	74-82	79.0	7.0-10.3	8.6
Clevelandia ios	arrow goby	3	35	35.0	0.4	0.4	-	-	-	-	-
Clupea pallasii	Pacific herring	-	-	-	-	-	65	51-93	65.5	1.5-7.9	3.0
Cymatogaster aggregata	shiner surfperch	5	40-92	65.8	1.4-15.6	7.9	86	35-105	51.0	0.9-25.4	4.1
Embiotocidae unid.	surfperches	-	-	-	-	-	1	-	-	-	-
Engraulis mordax	northern anchovy	9	100-107	103.8	7.3-9.4	8.6	547	65-134	96.4	2.5-19.0	7.1
Gasterosteus aculeatus	threespine stickleback	6	24-64	38.2	0.1-3.3	0.9	2	34-45	39.5	0.5-1.1	0.8
Hyperprosopon argenteum	walleye surfperch	-	-	-	-	-	1	75	75.0	9.8	9.8
Lepidogobius lepidus	bay goby	14	67-94	83.1	3.3-9.0	6.6	8	84-97	87.9	5.7-8.6	6.9
Leptocottus armatus	Pacific staghorn sculpin	7	83-105	90.6	8.2-25.0	13.8	12	51-115	81.4	1.5-33.6	11.0
Oncorhynchus tshawytscha	Chinook salmon	1	122	122.0	21.0	21.0	-	-	-	-	-
Parophrys vetulus	English sole	-	-	-	-	-	15	60-102	94.5	3.6-143.0	29.9
Peprilus simillimus	Pacific butterfish	-	-	-	-	-	2	39-57	48.0	1.3-3.5	2.4
Phanerodon atripes	sharpnose seaperch	-	-	-	-	-	1	82	82.0	12.7	12.7
Phanerodon furcatus	white surfperch	-	-	-	-	-	4	50-60	57.0	2.6-5.2	4.1
Platichthys stellatus	starry flounder	1	235	235.0	425.0	425.0	2	95-112	103.5	18.8-22.5	20.6
Platyrhinoidis triseriata	thornback	-	-	-	-	-	3	182-351	253.3	297.1-1,520.0	955.7
Porichthys notatus	plainfin midshipman	2	54-81	67.5	2.4-7.1	4.8	46	45-62	52.7	1.0-2.4	1.7
Sardinops sagax	Pacific sardine	-	-	-	-	-	6	74-125	88.3	4.5-16.5	7.2
Scorpaenichthys marmoratus	cabezon	-	-	-	-	-	2	83-110	96.5	14.3-34.2	24.3
Spirinchus starksi	night smelt	-	-	-	-	-	2	94-107	100.5	7.7-9.3	8.5
Symphurus atricauda	California tonguefish	2	89-117	103.0	5.5-14.5	10.0	6	72-90	80.2	3.8-7.3	5.2
Syngnathus spp.	pipefishes	7	131-251	199.0	0.7-4.6	2.9	2	219-298	258.5	2.5-8.2	5.3
Trachurus symmetricus	jack mackerel	-	-	-	-	-	1	95	95.0	8.7	8.7
INVERTEBRATES											
Cancer antennarius	brown rock crab	3	37	37.0	11.5	11.5	-	-	-	-	-
Cancer gracilis	slender crab	-	-	-	-	-	1	53	53.0	36.5	36.5
Cancer jordani	hairy rock crab	8	22-25	23.5	3.6-4.2	4.0	1	-	-	-	-
Cancer magister	dungeness crab	1	28	28.0	4.1	4.1	7	40-60	48.7	10.4-27.7	17.3
Cancer productus	red rock crab	2	19-21	20.0	1.4-1.7	1.6	-	-	-	-	-
Cancer spp.	cancer crabs	5	10-17	14.0	0.5-1.7	1.2	1	6	6.0	0.3	0.3
Crangon franciscorum	Franciscan bay shrimp	-	-	-	-	-	1	13	13.0	2.8	2.8
Crangon nigricauda	black-tailed bay shrimp	1	5	5.0	0.4	0.4	1	7	7.0	0.6	0.6

*Totals for Units 1&2 include bar rack sample totals.

(continued)

Table B-40 continued. Moss Landing Power Plant Impingement Abundance Survey 40, August 16, 2006.

Taxon	Common Name	Units 1&2* Count	Units 1&2* Length Range (mm)	Units 1&2* Length Average (mm)	Units 1&2* Weight Range (g)	Units 1&2* Weight Average (g)	Units 6&7 Count	Units 6&7 Length Range (mm)	Units 6&7 Length Average (mm)	Units 6&7 Weight Range (g)	Units 6&7 Weight Average (g)
INVERTEBRATES (continued)											
Crangon nigromaculata	spotted bay shrimp	-	-	-	-	-	3	7-12	9.7	0.9-1.8	1.5
Crangon spp.	bay shrimp	285	6-14	9.9	0.1-5.2	0.9	211	4-16	9.8	0.4-5.2	1.5
Hemigrapsus oregonensis	yellow shore crab	-	-	-	-	-	3	5-20	14.3	0.2-6.3	4.2
Heptacarpus spp.	tidepool shrimps	-	-	-	-	-	1	5	5.0	1.2	1.2
Loligo opalescens	market squid	-	-	-	-	-	1	81	81.0	1.9	1.9
Pachygrapsus crassipes	striped shore crab	3	7-27	18.7	0.4-10.8	5.7	-	-	-	-	-
Pandalopsis dispar	sidestriped shrimp	-	-	-	-	-	1	18	18.0	3.9	3.9
Pugettia producta	northern kelp crab	7	23-29	25.3	7.1-13.7	10.0	15	20-55	36.0	4.2-64.1	23.8
Pugettia richii	cryptic kelp crab	-	-	-	-	-	2	13-22	17.5	3.1-8.1	5.6

Table B-41. Moss Landing Power Plant Impingement Abundance Survey 41, August 23, 2006.

Taxon	Common Name	Units 1&2* Count	Units 1&2* Length Range (mm)	Units 1&2* Length Average (mm)	Units 1&2* Weight Range (g)	Units 1&2* Weight Average (g)	Units 6&7 Count	Units 6&7 Length Range (mm)	Units 6&7 Length Average (mm)	Units 6&7 Weight Range (g)	Units 6&7 Weight Average (g)
FISHES											
Artedius notospilotus	bonyhead sculpin	1	109	109.0	31.6	31.6	-	-	-	-	-
Atherinops affinis	topsmelt	12	44-79	63.8	0.6-5.3	2.6	281	66-136	88.3	2.3-22.6	6.2
Citharichthys sordidus	Pacific sanddab	-	-	-	-	-	3	126	126.0	28.1-31.8	30.5
Citharichthys stigmaeus	speckled sanddab	1	62	62.0	3.7	3.7	18	68-93	75.1	5.3-11.4	6.3
Clevelandia ios	arrow goby	1	46	46.0	1.1	1.1	-	-	-	-	-
Clupea pallasii	Pacific herring	-	-	-	-	-	229	45-130	71.1	1.0-26.9	4.2
Cymatogaster aggregata	shiner surfperch	2	90-97	93.5	17.8-20.9	19.3	65	36-97	53.9	1.0-22.5	4.5
Engraulis mordax	northern anchovy	12	80-109	99.6	4.0-13.1	8.5	14,619	72-124	93.6	3.5-12.7	4.4
Gasterosteus aculeatus	threespine stickleback	5	26-53	36.8	0.2-1.9	0.7	72	44-74	53.3	1.0-6.9	3.4
Gibbonsia metzi	striped kelpfish	-	-	-	-	-	1	135	135.0	27.2	27.2
Hyperprosopon argenteum	walleye surfperch	-	-	-	-	-	2	57-70	63.5	4.0-8.2	6.1
Lepidogobius lepidus	bay goby	10	78-97	84.8	2.3-9.8	6.6	38	77-88	84.3	5.6-8.1	6.9
Leptocottus armatus	Pacific staghorn sculpin	4	90-98	93.8	12.8-15.3	14.4	48	72-117	93.6	4.4-27.1	14.2
Parophrys vetulus	English sole	-	-	-	-	-	21	62-109	85.8	2.3-19.7	11.1
Peprilus simillimus	Pacific butterfish	-	-	-	-	-	9	31-112	63.7	0.6-26.8	4.5
Platichthys stellatus	starry flounder	-	-	-	-	-	8	108-256	182.0	26.0-245.6	54.2
Porichthys notatus	plainfin midshipman	-	-	-	-	-	36	44-64	54.3	1.1-3.0	1.8
Sardinops sagax	Pacific sardine	-	-	-	-	-	1	80	80.0	4.5	4.5
Scorpaenichthys marmoratus	cabezon	3	40-110	83.7	1.7-34.7	20.0	3	117-137	125.3	42.4-69.7	53.7
Spirinchus starksi	night smelt	-	-	-	-	-	23	103-105	104.3	8.0-9.3	8.5
Squalus acanthias	spiny dogfish shark	-	-	-	-	-	1	237	237.0	43.0	43.0
Symphurus atricauda	California tonguefish	1	93	93.0	8.0	8.0	18	80-91	85.5	5.0-8.2	6.7
Syngnathus spp.	pipefishes	22	120-240	192.6	0.2-4.5	2.4	8	128-247	188.5	0.6-7.2	2.5
Torpedo californica	Pacific electric ray	-	-	-	-	-	6	152-237	191.7	168.9-570.0	312.2
Trachurus symmetricus	jack mackerel	-	-	-	-	-	7	74	74.0	3.7-3.8	3.8
unidentified fish, damaged	unidentified damaged fish	1	-	-	-	-	3	-	-	-	-
INVERTEBRATES											
Cancer antennarius	brown rock crab	1	55	55.0	35.0	35.0	4	24-62	45.0	3.7-53.1	25.6
Cancer gracilis	slender crab	-	-	-	-	-	2	59-95	77.0	42.3-150.3	96.3
Cancer jordani	hairy rock crab	9	14-27	19.4	0.8-4.7	2.3	2	20-39	29.5	3.7-14.7	9.2
Cancer magister	dungeness crab	-	-	-	-	-	9	36-74	50.4	7.9-50.6	19.7
Cancer productus	red rock crab	6	8-34	16.8	0.1-5.5	1.3	4	18-104	66.3	0.6-181.6	74.5
Cancer spp.	cancer crabs	1	6	6.0	0.1	0.1	-	-	-	-	-
Chionoecetes tanneri	grooved tanner crab	2	141-144	142.5	380.0-386.8	383.4	-	-	-	-	-
Crangon franciscorum	Franciscan bay shrimp	-	-	-	-	-	3	11-12	11.7	0.9-1.5	1.3
Crangon nigricauda	black-tailed bay shrimp	2	11	11.0	1.4-1.7	1.6	8	9-12	11.1	0.5-2.0	1.5

*Totals for Units 1&2 include bar rack sample totals.

(continued)

Table 41 continued. Moss Landing Power Plant Impingement Abundance Survey 41, August 23, 2006.

Taxon	Common Name	Units 1&2* Count	Units 1&2* Length Range (mm)	Units 1&2* Length Average (mm)	Units 1&2* Weight Range (g)	Units 1&2* Weight Average (g)	Units 6&7 Count	Units 6&7 Length Range (mm)	Units 6&7 Length Average (mm)	Units 6&7 Weight Range (g)	Units 6&7 Weight Average (g)
INVERTEBRATES (continued)											
Crangon nigromaculata	spotted bay shrimp	3	10-11	10.7	0.4-2.3	1.3	6	8-17	11.7	0.5-4.6	1.9
Crangon spp.	bay shrimp	103	7-15	11.4	0.4-3.6	1.3	624	8-16	11.6	0.7-4.1	1.5
Hemigrapsus oregonensis	yellow shore crab	-	-	-	-	-	2	25-30	27.5	7.2-8.1	7.7
Loligo opalescens	market squid	-	-	-	-	-	5	60-112	77.8	1.6-4.6	2.7
Octopus rubescens	East Pacific red octopus	-	-	-	-	-	1	410	410.0	163.7	163.7
Pachygrapsus crassipes	striped shore crab	3	12-31	22.3	0.9-16.2	7.8	3	21-25	22.7	3.8-6.9	5.4
Protothaca spp.	unidentified littleneck clam	2	34-45	39.5	12.5-32.4	22.5	-	-	-	-	-
Pugettia producta	northern kelp crab	5	18-43	31.4	3.4-39.5	16.3	15	18-72	37.7	2.8-209.3	38.5

*Totals for Units 1&2 include bar rack sample totals.

Table B-42. Moss Landing Power Plant Impingement Abundance Survey 42, August 30, 2006.

Taxon	Common Name	Units 1&2* Count	Length Range (mm)	Length Average (mm)	Weight Range (g)	Weight Average (g)	Units 6&7 Count	Length Range (mm)	Length Average (mm)	Weight Range (g)	Weight Average (g)
FISHES											
Acanthogobius flavimanus	yellowfin goby	1	108	108.0	16.0	16.0	Not operating, therefore no sampling.				
Atherinops affinis	topsmelt	15	47-89	70.0	0.9-7.0	3.6					
Clupea pallasii	Pacific herring	1	61	61.0	1.8	1.8					
Cymatogaster aggregata	shiner surfperch	1	86	86.0	11.3	11.3					
Engraulis mordax	northern anchovy	20	87-115	96.1	4.5-14.4	7.5					
Gasterosteus aculeatus	threespine stickleback	9	22-40	31.7	0.1-0.9	0.4					
Lepidogobius lepidus	bay goby	16	65-90	82.8	3.3-9.1	6.4					
Leptocottus armatus	Pacific staghorn sculpin	10	88-108	95.5	10.8-19.8	14.5					
Parophrys vetulus	English sole	1	54	54.0	1.5	1.5					
Phanerodon furcatus	white surfperch	1	-	-	-	-					
Platichthys stellatus	starry flounder	1	83	83.0	11.7	11.7					
Porichthys notatus	plainfin midshipman	2	49-58	53.5	1.5-2.3	1.9					
Scorpaenichthys marmoratus	cabezon	1	104	104.0	27.1	27.1					
Spirinchus starksi	night smelt	1	106	106.0	8.1	8.1					
Symphurus atricauda	California tonguefish	2	84	84.0	4.2-5.0	4.6					
Syngnathus spp.	pipefishes	21	143-240	191.3	0.5-5.0	2.1					
unidentified fish, damaged	unidentified damaged fish	1	-	-	-	-					
INVERTEBRATES											
Cancer antennarius	brown rock crab	1	46	46.0	25.1	25.1					
Cancer jordani	hairy rock crab	16	12-26	18.4	0.7-5.3	2.1					
Cancer magister	dungeness crab	2	43-44	43.5	10.5-12.1	11.3					
Cancer productus	red rock crab	1	29	29.0	3.9	3.9					
Crangon alaskensis	northern crangon	1	9	9.0	0.9	0.9					
Crangon nigricauda	black-tailed bay shrimp	1	11	11.0	1.4	1.4					
Crangon nigromaculata	spotted bay shrimp	7	7-10	8.7	0.3-1.1	0.7					
Crangon spp.	bay shrimp	353	4-16	10.5	0.1-3.3	1.1					
Pachygrapsus crassipes	striped shore crab	5	14-28	22.4	1.6-10.7	6.4					
Pugettia producta	northern kelp crab	3	14-53	34.7	1.4-56.4	27.0					

*Totals for Units 1&2 include bar rack sample totals.

Table B-43. Moss Landing Power Plant Impingement Abundance Survey 43, September 6, 2006.

Taxon	Common Name	Units 1&2* Count	Units 1&2* Length Range (mm)	Units 1&2* Length Average (mm)	Units 1&2* Weight Range (g)	Units 1&2* Weight Average (g)	Units 6&7 Count	Units 6&7 Length Range (mm)	Units 6&7 Length Average (mm)	Units 6&7 Weight Range (g)	Units 6&7 Weight Average (g)
FISHES											
Acanthogobius flavimanus	yellowfin goby	1	121	121.0	20.8	20.8	1	82	82.0	8.1	8.1
Artedius notospilotus	bonyhead sculpin	-	-	-	-	-	1	69	69.0	6.2	6.2
Atherinops affinis	topsmelt	11	52-86	67.0	1.0-5.8	2.9	8	62-94	78.4	2.3-7.4	4.7
Atherinopsidae unid.	silversides	1	20	20.0	0.1	0.1	-	-	-	-	-
Citharichthys stigmaeus	speckled sanddab	-	-	-	-	-	2	77-93	85.0	6.5-12.3	9.4
Clupea pallasii	Pacific herring	-	-	-	-	-	6	49-91	73.5	1.3-8.4	4.5
Cymatogaster aggregata	shiner surfperch	-	-	-	-	-	3	37-66	54.0	1.3-5.8	3.9
Engraulis mordax	northern anchovy	16	67-116	97.2	3.0-12.7	7.4	342	82-249.6	96.3	1.9-13.0	6.6
Gasterosteus aculeatus	threespine stickleback	8	23-52	36.4	0.1-1.9	0.7	4	50-53	51.3	1.6-2.2	1.9
Hyperprosopon argenteum	walleye surfperch	-	-	-	-	-	1	76	76.0	7.8	7.8
Lepidogobius lepidus	bay goby	10	71-94	86.0	4.1-8.3	6.6	12	80-96	87.6	5.5-9.0	7.2
Leptocottus armatus	Pacific staghorn sculpin	12	46-104	89.3	2.1-19.1	12.9	18	83-115	98.6	9.6-23.4	16.7
Parophrys vetulus	English sole	1	95	95.0	10.1	10.1	3	90-105	99.0	9.7-15.8	13.7
Peprilus simillimus	Pacific butterfish	-	-	-	-	-	1	57	57.0	3.9	3.9
Phanerodon furcatus	white surfperch	1	78	78.0	9.0	9.0	-	-	-	-	-
Porichthys notatus	plainfin midshipman	8	53-77	62.6	2.0-4.7	3.0	21	52-77	63.7	2.0-4.5	2.9
Scorpaenichthys marmoratus	cabezon	5	75-143	107.3	9.6-77.9	26.1	4	61-177	123.3	5.6-145.7	69.8
Symphurus atricauda	California tonguefish	-	-	-	-	-	5	80-97	87.0	5.0-10.1	7.3
Syngnathus spp.	pipefishes	25	132-243	193.4	0.4-6.2	2.7	2	175-280	227.5	2.5-11.8	7.2
INVERTEBRATES											
Cancer antennarius	brown rock crab	4	41-101	73.0	19.8-248.8	111.8	1	74	74.0	64.8	64.8
Cancer gracilis	slender crab	-	-	-	-	-	1	42	42.0	17.6	17.6
Cancer jordani	hairy rock crab	28	8-32	17.5	0.3-41.9	5.5	1	14	14.0	1.3	1.3
Cancer magister	dungeness crab	1	9	9.0	0.3	0.3	5	38-57	48.0	10.4-26.3	18.7
Cancer productus	red rock crab	6	9-103	34.8	0.2-148.8	74.7	2	58-98	78.0	30.9-142.3	86.6
Crangon franciscorum	Franciscan bay shrimp	-	-	-	-	-	2	8-10	9.0	1.3-1.8	1.5
Crangon nigricauda	black-tailed bay shrimp	14	5-12	8.5	0.3-3.2	1.6	1	6	6.0	0.6	0.6
Crangon nigromaculata	spotted bay shrimp	2	10	10.0	1.6-2.2	1.9	-	-	-	-	-
Crangon spp.	bay shrimp	103	5-16	9.9	0.5-3.6	1.5	144	6-17	10.7	0.5-4.3	1.5
Hemigrapsus oregonensis	yellow shore crab	1	19	19.0	4.2	4.2	1	17	17.0	3.2	3.2
Loligo opalescens	market squid	-	-	-	-	-	1	94	94.0	7.1	7.1
Lophopanopeus bellus	black-claw crestleg crab	-	-	-	-	-	2	10-13	11.5	0.5-2.2	1.4
Pachycheles rudis	thickclaw porcelain crab	1	8	8.0	2.2	2.2	-	-	-	-	-
Pachygrapsus crassipes	striped shore crab	7	16-28	22.6	2.6-10.4	7.1	3	22-31	27.7	4.7-17.0	11.5
Pugettia producta	northern kelp crab	10	5-48	21.3	0.3-51.1	10.4	6	15-64	31.0	2.0-125.8	35.3
Pugettia richii	cryptic kelp crab	1	11	11.0	2.5	2.5	1	14	14.0	1.8	1.8
Scyra acutifrons	sharp-nosed crab	1	18	18.0	8.7	8.7	-	-	-	-	-

*Totals for Units 1&2 include bar rack sample totals.

Table B-44. Moss Landing Power Plant Impingement Abundance Survey 44, September 13, 2006.

Taxon	Common Name	Units 1&2* Count	Length Range (mm)	Length Average (mm)	Weight Range (g)	Weight Average (g)	Units 6&7 Count	Length Range (mm)	Length Average (mm)	Weight Range (g)	Weight Average (g)
FISHES											
Acanthogobius flavimanus	yellowfin goby	1	124	124.0	23.6	23.6	Not operating, therefore no sampling.				
Artedius harringtoni	scalyhead sculpin	1	59	59.0	4.9	4.9					
Atherinops affinis	topsmelt	6	59-87	68.6	1.5-6.2	3.0					
Clevelandia ios	arrow goby	2	39-45	42.0	0.5-0.8	0.7					
Cymatogaster aggregata	shiner surfperch	1	95	95.0	25.7	25.7					
Engraulis mordax	northern anchovy	14	92-108	100.8	6.1-10.8	8.1					
Gasterosteus aculeatus	threespine stickleback	12	22-50	39.6	0.1-1.9	0.9					
Lepidogobius lepidus	bay goby	9	80-95	88.0	4.5-8.7	7.2					
Leptocottus armatus	Pacific staghorn sculpin	14	80-120	95.1	7.5-27.1	14.1					
Phanerodon furcatus	white surfperch	1	83	83.0	11.8	11.8					
Platichthys stellatus	starry flounder	1	81	81.0	8.1	8.1					
Porichthys notatus	plainfin midshipman	12	43-80	59.5	1.1-6.2	2.7					
Scorpaenichthys marmoratus	cabezon	2	105-140	122.5	29.8-82.7	56.2					
Symphurus atricauda	California tonguefish	2	80-95	87.5	5.2-8.5	6.8					
Syngnathus spp.	pipefishes	10	129-261	199.3	0.7-4.8	2.8					
INVERTEBRATES											
Cancer antennarius	brown rock crab	1	49	49.0	27.9	27.9					
Cancer jordani	hairy rock crab	14	13-34	23.6	0.6-10.7	4.3					
Cancer productus	red rock crab	2	14-24	19.0	0.4-1.8	1.1					
Cancer spp.	cancer crabs	5	11-17	14.2	0.5-1.6	1.0					
Crangon alaskensis	northern crangon	2	9-10	9.5	0.7-1.3	1.0					
Crangon franciscorum	Franciscan bay shrimp	2	11-12	11.5	1.4-1.6	1.5					
Crangon nigricauda	black-tailed bay shrimp	24	7-16	11.2	0.4-4.0	1.7					
Crangon nigromaculata	spotted bay shrimp	18	6-13	9.8	0.2-2.9	1.2					
Crangon spp.	bay shrimp	56	8-13	11.2	0.4-2.7	1.5					
Heptacarpus spp.	tidepool shrimps	1	6	6.0	0.1	0.1					
Lophopanopeus bellus	black-claw crestleg crab	1	13	13.0	1.2	1.2					
Pachygrapsus crassipes	striped shore crab	4	12-30	19.5	0.8-11.9	4.5					
Pugettia producta	northern kelp crab	3	13-26	17.7	1.2-9.1	3.9					

*Totals for Units 1&2 include bar rack sample totals.

Table B-45. Moss Landing Power Plant Impingement Abundance Survey 45, September 20, 2006.

Taxon	Common Name	Units 1&2* Count	Length Range (mm)	Length Average (mm)	Weight Range (g)	Weight Average (g)	Units 6&7 Count	Length Range (mm)	Length Average (mm)	Weight Range (g)	Weight Average (g)
FISHES											
Acanthogobius flavimanus	yellowfin goby	1	117	117.0	20.2	20.2	Not operating, therefore no sampling.				
Artedius notospilotus	bonyhead sculpin	2	42-99	70.5	1.8-23.7	12.8					
Atherinops affinis	topsmelt	9	50-83	68.3	0.8-5.3	3.1					
Clevelandia ios	arrow goby	2	39-41	40.0	0.5-0.6	0.6					
Clupea pallasii	Pacific herring	1	105	105.0	10.8	10.8					
Cottidae unid.	sculpins	1	30	30.0	0.4	0.4					
Cymatogaster aggregata	shiner surfperch	2	52-111	81.5	3.1-24.5	13.8					
Engraulis mordax	northern anchovy	10	91-111	98.9	5.9-11.5	7.9					
Gasterosteus aculeatus	threespine stickleback	6	25-41	31.3	0.1-1.0	0.4					
Lepidogobius lepidus	bay goby	7	52-96	70.1	2.4-15.7	5.6					
Leptocottus armatus	Pacific staghorn sculpin	10	83-120	93.6	9.3-27.4	13.6					
Neoclinus uninotatus	onespot fringehead	1	112	112.0	12.1	12.1					
Platichthys stellatus	starry flounder	3	86-123	103.0	13.8-44.1	25.6					
Porichthys notatus	plainfin midshipman	11	42-75	52.7	0.9-4.5	1.8					
Scorpaenichthys marmoratus	cabezon	1	116	116.0	35.3	35.3					
Symphurus atricauda	California tonguefish	1	93	93.0	7.5	7.5					
Syngnathus spp.	pipefishes	29	121-335	190.2	0.2-10.8	2.4					
INVERTEBRATES											
Cancer antennarius	brown rock crab	3	34-71	51.0	12.6-93.0	44.9					
Cancer jordani	hairy rock crab	8	11-34	22.4	0.4-8.3	3.7					
Cancer productus	red rock crab	1	52	52.0	27.0	27.0					
Crangon franciscorum	Franciscan bay shrimp	2	9-17	13.0	1.0-3.4	2.2					
Crangon nigricauda	black-tailed bay shrimp	31	8-15	11.6	0.4-2.8	1.8					
Crangon nigromaculata	spotted bay shrimp	8	10-14	11.6	1.0-2.8	1.7					
Crangon spp.	bay shrimp	39	7-14	10.7	0.4-2.8	1.5					
Hemigrapsus oregonensis	yellow shore crab	2	21-22	21.5	6.1-6.4	6.3					
Pachygrapsus crassipes	striped shore crab	3	16-31	22.3	1.4-9.6	5.2					
Protothaca staminea	Pacific littleneck	1	46	46.0	44.3	44.3					
Pugettia producta	northern kelp crab	14	11-52	26.1	1.1-66.8	15.8					
Pugettia richii	cryptic kelp crab	1	8	8.0	0.4	0.4					

*Totals for Units 1&2 include bar rack sample totals.

Table B-46. Moss Landing Power Plant Impingement Abundance Survey 46, September 27, 2006.

		Units 1&2*					Units 6&7				
			Length		Weight			Length		Weight	
Taxon	Common Name	Count	Range (mm)	Average	Range (g)	Average	Count	Range (mm)	Average	Range (g)	Average
FISHES											
Artedius harringtoni	scalyhead sculpin	1	48	48.0	2.6	2.6	Not operating, therefore no sampling.				
Artedius notospilotus	bonyhead sculpin	4	53-85	64.8	3.5-18.2	8.3					
Atherinops affinis	topsmelt	4	58-92	76.8	1.4-7.7	4.9					
Cymatogaster aggregata	shiner surfperch	1	95	95.0	20.4	20.4					
Engraulis mordax	northern anchovy	12	90-114	97.6	5.6-12.9	7.5					
Gasterosteus aculeatus	threespine stickleback	5	34-74	48.0	0.5-4.4	1.7					
Lepidogobius lepidus	bay goby	8	74-93	86.9	4.4-8.3	6.9					
Leptocottus armatus	Pacific staghorn sculpin	7	85-105	95.9	13.9-16.9	15.4					
Porichthys notatus	plainfin midshipman	1	28	28.0	0.2	0.2					
Scorpaenichthys marmoratus	cabezon	4	106-155	123.8	34.3-106.4	56.6					
Syngnathus spp.	pipefishes	11	125-213	173.9	0.3-3.2	1.6					
INVERTEBRATES											
Cancer antennarius	brown rock crab	4	35-74	51.0	10.9-59.8	33.0					
Cancer jordani	hairy rock crab	9	17-37	23.6	2.7-15.2	5.7					
Cancer productus	red rock crab	3	25-38	30.0	2.7-10.3	5.4					
Cancer spp.	cancer crabs	2	8-14	11.0	0.4-1.6	1.0					
Crangon nigricauda	black-tailed bay shrimp	7	6-14	9.4	0.6-2.1	1.5					
Crangon nigromaculata	spotted bay shrimp	4	7-10	8.8	0.9-2.0	1.6					
Pachygrapsus crassipes	striped shore crab	7	9-29	20.0	0.5-11.2	6.1					
Pugettia producta	northern kelp crab	4	11-48	24.5	1.0-51.4	16.2					

*Totals for Units 1&2 include bar rack sample totals.

Table B-47. Moss Landing Power Plant Impingement Abundance Survey 47, October 4, 2006.

Taxon	Common Name	Units 1&2* Count	Length Range (mm)	Length Average (mm)	Weight Range (g)	Weight Average (g)	Units 6&7 Count	Length Range (mm)	Length Average (mm)	Weight Range (g)	Weight Average (g)
FISHES											
Atherinops affinis	topsmelt	11	32-134	70.1	0.2-20.2	4.9	Not operating, therefore no sampling.				
Citharichthys stigmaeus	speckled sanddab	1	87	87.0	12.6	12.6					
Clevelandia ios	arrow goby	2	39-49	44.0	0.5-0.9	0.7					
Cymatogaster aggregata	shiner surfperch	3	63-102	80.3	6.2-28.2	14.4					
Engraulis mordax	northern anchovy	25	64-109	95.9	2.0-12.7	7.3					
Gasterosteus aculeatus	threespine stickleback	3	33-43	37.3	0.4-1.0	0.7					
Lepidogobius lepidus	bay goby	4	78-88	83.8	4.7-6.7	5.9					
Leptocottus armatus	Pacific staghorn sculpin	8	81-115	98.0	8.9-27.3	16.6					
Phanerodon furcatus	white surfperch	1	89	89.0	15.9	15.9					
Platichthys stellatus	starry flounder	1	100	100.0	28.0	28.0					
Pleuronichthys verticalis	hornyhead turbot	1	59	59.0	5.1	5.1					
Porichthys notatus	plainfin midshipman	53	43-97	58.6	1.1-10.3	2.6					
Symphurus atricauda	California tonguefish	4	87-105	95.0	8.0-13.9	10.1					
Syngnathus spp.	pipefishes	6	158-204	175.2	0.6-5.6	1.9					
INVERTEBRATES											
Cancer antennarius	brown rock crab	8	17-63	39.8	1.8-53.5	23.5					
Cancer anthonyi	yellow crab	2	46-57	51.5	3.3-11.8	7.6					
Cancer gracilis	slender crab	1	36	36.0	12.2	12.2					
Cancer jordani	hairy rock crab	8	10-27	18.8	0.6-6.4	3.0					
Cancer productus	red rock crab	1	20	20.0	0.9	0.9					
Cancer spp.	cancer crabs	3	15-20	16.7	0.9-2.0	1.3					
Crangon franciscorum	Franciscan bay shrimp	1	16	16.0	3.1	3.1					
Crangon nigricauda	black-tailed bay shrimp	5	5-13	9.2	0.3-2.1	1.2					
Crangon nigromaculata	spotted bay shrimp	12	6-13	9.8	1.0-2.7	1.9					
Hemigrapsus oregonensis	yellow shore crab	3	13-18	14.7	1.4-4.2	2.6					
Pachygrapsus crassipes	striped shore crab	9	11-27	18.7	0.8-11.8	4.9					
Pugettia producta	northern kelp crab	15	8-57	23.5	0.5-86.8	13.6					

*Totals for Units 1&2 include bar rack sample totals.

Table B-48. Moss Landing Power Plant Impingement Abundance Survey 48, October 11, 2006.

		Units 1&2*					Units 6&7				
			Length		Weight			Length		Weight	
Taxon	Common Name	Count	Range (mm)	Average	Range (g)	Average	Count	Range (mm)	Average	Range (g)	Average
FISHES											
Acanthogobius flavimanus	yellowfin goby	1	115	115.0	17.9	17.9	Not operating, therefore no sampling.				
Artedius notospilotus	bonyhead sculpin	2	57-81	69.0	4.0-12.5	8.3					
Atherinops affinis	topsmelt	17	57-104	73.6	1.3-9.6	4.0					
Atherinopsidae unid.	silversides	1	-	-	-	-					
Cymatogaster aggregata	shiner surfperch	4	67-87	77.0	7.9-16.1	12.0					
Cyprinidae unid.	minnows and carps	1	42	42.0	1.1	1.1					
Engraulis mordax	northern anchovy	15	89-143	104.6	5.7-19.5	9.1					
Gasterosteus aculeatus	threespine stickleback	6	34-42	36.6	0.3-0.7	0.5					
Gibbonsia metzi	striped kelpfish	1	138	138.0	31.8	31.8					
Hydrolagus colliei	ratfish	1	428	428.0	600.0	600.0					
Lepidogobius lepidus	bay goby	7	74-91	82.4	4.6-7.7	6.1					
Leptocottus armatus	Pacific staghorn sculpin	11	89-117	101.0	12.4-24.1	17.1					
Leuresthes tenuis	California grunion	1	61	61.0	1.6	1.6					
Porichthys notatus	plainfin midshipman	26	48-82	60.8	1.2-6.4	2.6					
Symphurus atricauda	California tonguefish	3	84-100	91.7	5.9-8.5	6.9					
Syngnathus spp.	pipefishes	4	199-245	221.0	1.6-7.5	4.0					
INVERTEBRATES											
Cancer antennarius	brown rock crab	9	29-104	65.5	7.3-335.5	98.9					
Cancer anthonyi	yellow crab	1	23	23.0	2.8	2.8					
Cancer gracilis	slender crab	2	21-68	44.5	1.7-65.4	33.6					
Cancer jordani	hairy rock crab	9	18-35	26.3	2.3-11.8	6.7					
Cancer spp.	cancer crabs	2	11	11.0	0.3-0.4	0.4					
Crangon franciscorum	Franciscan bay shrimp	7	7-12	9.9	1.1-2.9	2.0					
Crangon nigricauda	black-tailed bay shrimp	3	9-10	9.7	1.5-2.4	1.8					
Crangon nigromaculata	spotted bay shrimp	6	9-13	11.5	1.0-2.4	1.7					
Crangon spp.	bay shrimp	1	7	7.0	0.4	0.4					
Loligo opalescens	market squid	1	-	-	-	-					
Pachygrapsus crassipes	striped shore crab	8	16-31	24.9	2.9-19.7	8.8					
Pugettia producta	northern kelp crab	5	11-40	27.0	1.2-39.3	21.4					

*Totals for Units 1&2 include bar rack sample totals.

Table B-49. Moss Landing Power Plant Impingement Abundance Survey 49, October 18, 2006.

Taxon	Common Name	Units 1&2* Count	Length Range (mm)	Length Average (mm)	Weight Range (g)	Weight Average (g)	Units 6&7 Count	Length Range (mm)	Length Average (mm)	Weight Range (g)	Weight Average (g)
FISHES											
Amphistichus argenteus	barred surfperch	1	210	210.0	308.5	308.5	Not operating, therefore no sampling.				
Artedius harringtoni	scalyhead sculpin	1	51	51.0	2.8	2.8					
Artedius notospilotus	bonyhead sculpin	7	54-109	79.7	4.0-37.0	17.7					
Atherinops affinis	topsmelt	202	49-101	67.9	0.9-10.8	2.8					
Atherinopsidae unid.	silversides	1	-	-	-	-					
Citharichthys stigmaeus	speckled sanddab	1	71	71.0	7.0	7.0					
Cymatogaster aggregata	shiner surfperch	1	62	62.0	6.1	6.1					
Engraulis mordax	northern anchovy	87	77-112	93.5	4.3-13.3	6.9					
Gasterosteus aculeatus	threespine stickleback	20	29-39	33.8	0.2-0.6	0.4					
Hypsoblennius gilberti	rockpool blenny	2	40-44	42.0	0.9-1.4	1.1					
Lepidogobius lepidus	bay goby	7	78-91	86.7	5.9-7.2	6.6					
Leptocottus armatus	Pacific staghorn sculpin	11	76-123	99.5	6.1-29.6	15.9					
Micrometrus minimus	dwarf surfperch	1	59	59.0	6.1	6.1					
Paralichthys californicus	California halibut	1	61	61.0	3.3	3.3					
Porichthys notatus	plainfin midshipman	34	30-73	57.7	0.4-4.5	2.4					
Scorpaenichthys marmoratus	cabezon	3	106-122	112.3	33.5-46.8	38.4					
Sebastes spp.	rockfishes	1	31	31.0	0.4	0.4					
Symphurus atricauda	California tonguefish	2	101-103	102.0	8.6-9.1	8.9					
Syngnathus spp.	pipefishes	11	136-222	179.2	0.3-4.7	1.6					
INVERTEBRATES											
Cancer antennarius	brown rock crab	12	18-74	38.1	1.7-81.6	21.7					
Cancer jordani	hairy rock crab	6	12-27	20.7	0.6-5.2	3.0					
Cancer productus	red rock crab	5	18-36	23.8	1.0-5.5	2.2					
Crangon franciscorum	Franciscan bay shrimp	3	13-14	13.7	2.4-2.7	2.6					
Crangon nigricauda	black-tailed bay shrimp	2	11	11.0	1.7-1.9	1.8					
Crangon nigromaculata	spotted bay shrimp	8	8-14	12.0	0.6-3.0	2.0					
Hemigrapsus oregonensis	yellow shore crab	4	6-14	10.8	0.1-1.6	0.7					
Loligo opalescens	market squid	2	96-101	98.5	8.9-9.0	8.9					
Pachygrapsus crassipes	striped shore crab	29	5-32	15.7	0.1-14.2	2.6					
Pugettia producta	northern kelp crab	1	16	16.0	2.5	2.5					
Scyra acutifrons	sharp-nosed crab	1	14	14.0	2.8	2.8					

*Totals for Units 1&2 include bar rack sample totals.

Table B-50. Moss Landing Power Plant Impingement Abundance Survey 50, October 25, 2006.

Taxon	Common Name	Units 1&2* Count	Length Range (mm)	Length Average (mm)	Weight Range (g)	Weight Average (g)	Units 6&7 Count	Length Range (mm)	Length Average (mm)	Weight Range (g)	Weight Average (g)
FISHES											
Artedius harringtoni	scalyhead sculpin	1	69	69.0	8.2	8.2	Not operating, therefore no sampling.				
Artedius notospilotus	bonyhead sculpin	1	59	59.0	4.9	4.9					
Atherinops affinis	topsmelt	32	56-107	78.5	0.9-11.2	4.8					
Citharichthys spp.	sanddabs	4	31-36	33.5	0.3-0.8	0.5					
Citharichthys stigmaeus	speckled sanddab	9	28-104	43.7	0.2-26.0	4.0					
Clevelandia ios	arrow goby	1	55	55.0	1.5	1.5					
Cymatogaster aggregata	shiner surfperch	9	68-100	85.8	7.6-20.8	15.0					
Engraulis mordax	northern anchovy	14	89-105	97.6	4.5-8.9	7.0					
Gasterosteus aculeatus	threespine stickleback	4	35-41	38.0	0.5-0.9	0.7					
Lepidogobius lepidus	bay goby	7	84-91	86.0	6.4-8.0	7.2					
Leptocottus armatus	Pacific staghorn sculpin	10	90-154	106.6	12.4-58.9	21.5					
Paralichthys californicus	California halibut	1	53	53.0	1.8	1.8					
Platichthys stellatus	starry flounder	1	105	105.0	22.0	22.0					
Platyrhinoidis triseriata	thornback	2	42-53	47.5	4.1-8.6	6.4					
Pleuronichthys verticalis	hornyhead turbot	3	52-57	54.7	3.2-3.7	3.5					
Porichthys notatus	plainfin midshipman	41	35-81	55.4	0.5-5.6	2.1					
Scorpaenichthys marmoratus	cabezon	1	156	156.0	99.7	99.7					
Symphurus atricauda	California tonguefish	1	96	96.0	8.1	8.1					
Syngnathus spp.	pipefishes	12	145-234	197.2	0.5-3.9	2.4					
INVERTEBRATES											
Cancer antennarius	brown rock crab	9	16-63	37.3	1.3-62.2	20.3					
Cancer jordani	hairy rock crab	3	17-21	19.3	1.6-3.1	2.4					
Cancer productus	red rock crab	7	27-86	51.1	1.0-79.8	26.1					
Crangon franciscorum	Franciscan bay shrimp	4	12-14	13.3	1.4-1.9	1.6					
Crangon nigricauda	black-tailed bay shrimp	17	9-14	11.5	0.4-3.3	1.8					
Crangon nigromaculata	spotted bay shrimp	12	6-16	11.8	0.3-3.0	1.6					
Crangon spp.	bay shrimp	261	9-18	13.5	0.5-4.3	1.5					
Hemigrapsus oregonensis	yellow shore crab	1	26	26.0	9.5	9.5					
Heptacarpus spp.	tidepool shrimps	2	6-9	7.5	0.3-0.7	0.5					
Pachygrapsus crassipes	striped shore crab	5	19-25	21.4	3.2-9.2	5.9					
Pugettia producta	northern kelp crab	8	15-49	32.4	2.9-57.8	25.2					

*Totals for Units 1&2 include bar rack sample totals.

Table B-51. Moss Landing Power Plant Impingement Abundance Survey 51, November 1, 2006.

Taxon	Common Name	Units 1&2* Count	Length Range (mm)	Length Average (mm)	Weight Range (g)	Weight Average (g)	Units 6&7 Count	Length Range (mm)	Length Average (mm)	Weight Range (g)	Weight Average (g)
FISHES											
Acanthogobius flavimanus	yellowfin goby	1	128	128.0	36.2	36.2	Not operating, therefore no sampling.				
Artedius notospilotus	bonyhead sculpin	2	72-121	96.5	8.8-42.2	25.5					
Atherinops affinis	topsmelt	28	61-104	77.2	1.9-12.3	4.6					
Citharichthys stigmaeus	speckled sanddab	6	29-37	32.2	0.4-0.7	0.5					
Clevelandia ios	arrow goby	1	49	49.0	0.9	0.9					
Cymatogaster aggregata	shiner surfperch	2	112	112.0	34.3	34.3					
Engraulis mordax	northern anchovy	4	90-100	94.0	4.6-8.6	6.3					
Gasterosteus aculeatus	threespine stickleback	8	34-42	36.9	0.4-1.2	0.6					
Lepidogobius lepidus	bay goby	5	74-93	84.8	3.8-7.8	6.0					
Leptocottus armatus	Pacific staghorn sculpin	6	103-134	113.2	16.5-28.7	21.7					
Myliobatis californica	bat ray	1	660	660.0	3,400.0	3,400.0					
Phanerodon furcatus	white surfperch	2	84-89	86.5	12.3-13.4	12.8					
Porichthys notatus	plainfin midshipman	53	40-174	59.0	0.7-6.7	2.4					
Rhinogobiops nicholsi	blackeye goby	1	55	55.0	2.8	2.8					
Scorpaenichthys marmoratus	cabezon	1	177	177.0	152.3	152.3					
Symphurus atricauda	California tonguefish	2	91-106	98.5	6.6-13.0	9.8					
Syngnathus spp.	pipefishes	20	130-247	181.6	0.4-4.4	2.0					
INVERTEBRATES											
Cancer antennarius	brown rock crab	3	28-80	47.7	5.6-101.8	38.7					
Cancer jordani	hairy rock crab	3	21-30	25.0	2.4-7.3	4.3					
Cancer productus	red rock crab	8	7-95	42.1	0.1-117.3	33.4					
Cancer spp.	cancer crabs	3	10-16	13.0	0.2-1.0	0.6					
Crangon alaskensis	northern crangon	1	9	9.0	0.5	0.5					
Crangon franciscorum	Franciscan bay shrimp	13	10-18	14.1	0.7-4.7	1.9					
Crangon nigricauda	black-tailed bay shrimp	26	8-15	11.2	0.4-3.0	1.4					
Crangon nigromaculata	spotted bay shrimp	46	10-16	13.8	0.8-4.0	2.5					
Loligo opalescens	market squid	1	132	132.0	9.5	9.5					
Pachygrapsus crassipes	striped shore crab	4	12-24	18.5	0.9-5.7	2.9					
Pandalus platyceros	spot shrimp	1	45	45.0	5.2	5.2					
Petrolisthes spp.	porcelain crabs	1	12	12.0	1.1	1.1					
Pugettia producta	northern kelp crab	20	11-52	22.1	0.8-65.4	9.2					

*Totals for Units 1&2 include bar rack sample totals.