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Chinook Salmon Data Storage Tag Studies in Southeast Alaska, 2002

by

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Abstract

Chinook salmon were tagged in May and June 2002 with temperature and pressure data storage tags during two surveys in coastal Southeast Alaska by scientists from the NOAA Fisheries, Auke Bay Laboratory. Eleven tags have been recovered to date from the 52 chinook salmon tagged this spring. The duration between tagging and recovery ranged between 12 and 67 days and the minimum distance traveled by each fish ranged between 0 and 895 nm. Three diel vertical migration patterns were apparent in the tagged chinook salmon: no apparent diel pattern, a standard diel migration behavior where they occupy their deepest daily depths during the day, and a reverse diel migration behavior where migrate to their deepest daily depths during the night.

Introduction

Data storage tag studies have provided new insight into the migratory behavior and habitat utilization of salmon on the high seas (Friedland et al. 2001; Wada and Ueno, 1999; Walker et al., 1999; Walker et al. 2000; Walker et al. 2001) and other species of fish (Stensholt, 2001). These studies have shown that salmon are vertically active during the day and remain at the surface with reduced activity during the night. Chinook salmon, however, do not always exhibit this diel pattern and can be more vertically active and reach their deepest depths during the night (Murphy and Heard, 2001). This report summarizes the continued tagging work on chinook salmon in Southeast Alaska during May and June 2002.

Methods

Two tagging surveys were completed by scientists from the NOAA Fisheries Auke Bay Laboratory (ABL) during May and June, 2002. The first tagging survey was conducted aboard the chartered sport troller, *F/V Shearwater*, between May 20 and May 22, 2002. The second survey was conducted aboard the chartered power troller, *F/V Tommy L II*, on June 11, 2002.

Chinook salmon were anesthetized with a battery powered shocking basket immediately after capture and scale samples and length measurements were collected. Data storage tags were secured to selected chinook salmon using nickel pins and a modified Petersen disk. An oval Petersen disk with two holes was used rather than the standard round disks with a single hole.

Data storage tags containing temperature and pressure sensors from Lotek Wireless Inc.¹ (model LTD1100-300) were used in this study. The LTD1100-300 tags are fully encapsulated in clear urethane and have dimensions of 8 mm x 16 mm x 27 mm and weigh 5 g. Data are stored in 32 k bytes of non-volatile EEPROM memory; calibration and timing data are stored in microprocessor RAM. The tags are capable of storing up to 16,384 samples each of temperature and pressure, have a 3 year battery life, transmit data through a light-emitting diode to an optical reader attached to a host computer, and use

¹ Reference to trade names does not imply endorsement by NOAA Fisheries Auke Bay Laboratory, Alaska Fisheries Science Center.

Time Extension Recording. Time Extension Recording enables the tags to begin recording at a base (short interval) sampling interval. The sampling interval is doubled once memory has been filled and data recording is continued, overwriting every other sample in memory. The doubling process is repeated until recovery or throughout the life of the battery. Pressure data range and resolution are automatically scaled to ambient conditions. The initial range is set to one-fourth of the instrument maximum (standard instrument maximum is 500 m). If that range is exceeded, it switches to half of the instrument maximum. If that is exceeded, it switches to the maximum range. The temperature sensor has a range of -5 to 35° C with a 0.20° C resolution.

Raw data from recovered tags were downloaded to a computer upon delivery to the Auke Bay Laboratory. Sample time and date were set to Alaska daylight savings time. Time-of-day was shifted by a half day to center the day at midnight rather than noon. Data prior to noon at the beginning of the time series and data past noon at the end of the time series were truncated to produce a regular array of data. Due to the time extension recording format of these tags, two data resolutions or sample time intervals were present on each of the recovered tags, and data resolutions varied from tag to tag depending on the length of time between tagging and tag recovery. As a result, data from each tag were reduced to its lowest resolution and all of the tags were subsequently reduced to the lowest common resolution. Daily sunrise and sunset times were estimated by a weighted average of sunrise and sunset times at the tagging and recovery locations. Sunrise and sunset times were obtained from the NOAA sunrise/sunset calculator (<http://www.srb.noaa.gov/highlights/sunrise/sunrise.html>). We used median daily vertical movement as a measure of activity to quantify the recovery period after tagging.

Results

A total of 52 chinook salmon were tagged with data storage tags at several locations in Southeast Alaska during May and June, 2002 (Table 1; Figure 1). Twelve chinook salmon were tagged in May and 40 were tagging in June. Four chinook salmon tagged at Hocktaheen, had missing adipose fins and may have had coded-wire tags. Most of the fish tagged during the surveys were between 70 and 80 cm in length (Table 2).

Data from nine tags are summarized in this report (Table 3; Figure 2). Eleven tagged chinook salmon have been recaptured to date, however, one fish was released without recovering the tag and one tag has been recovered but not yet arrived at Auke Bay Laboratory. Four of the nine recoveries were from the May charter and five were from the April survey. The duration between tagging and recovery ranged between 12 and 67 days and the minimum distance traveled by each fish ranged between 0 and 895 nm. Temperature and depth data are summarized in Figures 3-11.

Chinook salmon with tag number 1396 (Figure 8) exhibited a reverse diel migration pattern. Chinook salmon with tag numbers 188 (Figure 7) and 1603 (Figure 10) exhibited a typical diel migration pattern. The remaining chinook salmon did not exhibit a clearly defined diel migration pattern. The tendency for maturing chinook salmon to remain up near the surface is apparent in the fish recovered with the tag number 54

(Figure 5). This chinook salmon was captured near the Medvejie Hatchery at an advanced stage of maturity.

Acknowledgements

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Table 1.—Dates, locations, and number of chinook salmon captured and tagged with data storage tags aboard the F/V *Shearwater* and the F/V *Tommy L II* during May and June, 2002.

Date	Location	Number Tagged
20-May-02	Point Mary	4
20-May-02	Point Amelia	2
21-May-02	Point Amelia	1
22-May-02	Cape Georgiana	5
	F/V <i>Shearwater</i> Total	12
<hr/>		
11-Jun-02	Hocktaheen	40
	F/V <i>Tommy L II</i> Total	40

Table 2.—Length frequency distribution chinook salmon tagged aboard the F/V *Shearwater* and the F/V *Tommy L II* during May and June, 2002. Number of recoveries from each length category is listed in parentheses.

Length (mm)	F/V <i>Shearwater</i>	F/V <i>Tommy L II</i>	Total Tagged
500 - 599		1 (0)	1
600 - 699		10 (1)	10
700 - 799	2 (2)	19 (1)	21
800 - 899	4 (2)	8 (2)	12
900 - 999	5 (2)	1 (1)	6
1000 - 1099	1 (0)	1 (0)	2
Total	12	40	52

Table 3.—Data storage tag recovery information from chinook salmon tagged aboard the F/V *Shearwater* and the F/V *Tommy L II* during May and April, 2002.

Tag Number	Release Date	Release Location	Release Length (mm)	Recovery Date	Recovery Location	Days	Min. Dist. Traveled (nm)
21	5/21/2002	Point Amelia	900	6/2/2002	Kalenin Bay	12	14
34	5/22/2002	Cape Georgiana	880	6/8/2002	Sitka Sound	18	40
54	5/22/2002	Cape Georgiana	900	6/30/2002	Medvejie	40	49
1348	5/20/2002	Point Mary	880	7/25/2002	Esperanza Inlet	67	659
1396	6/11/2002	Hocktaheen	770	6/29/2002	Point Mary	19	67
941	6/11/2002	Hocktaheen	810	7/3/2002	Craig	23	260
188	6/11/2002	Hocktaheen	640	7/7/2002	Hocktaheen	27	0
132	6/11/2002	Hocktaheen	810	7/11/2002	Fraser River	31	895
1603	6/11/2002	Hocktaheen	920	8/3/2002	Renell Sound	54	362

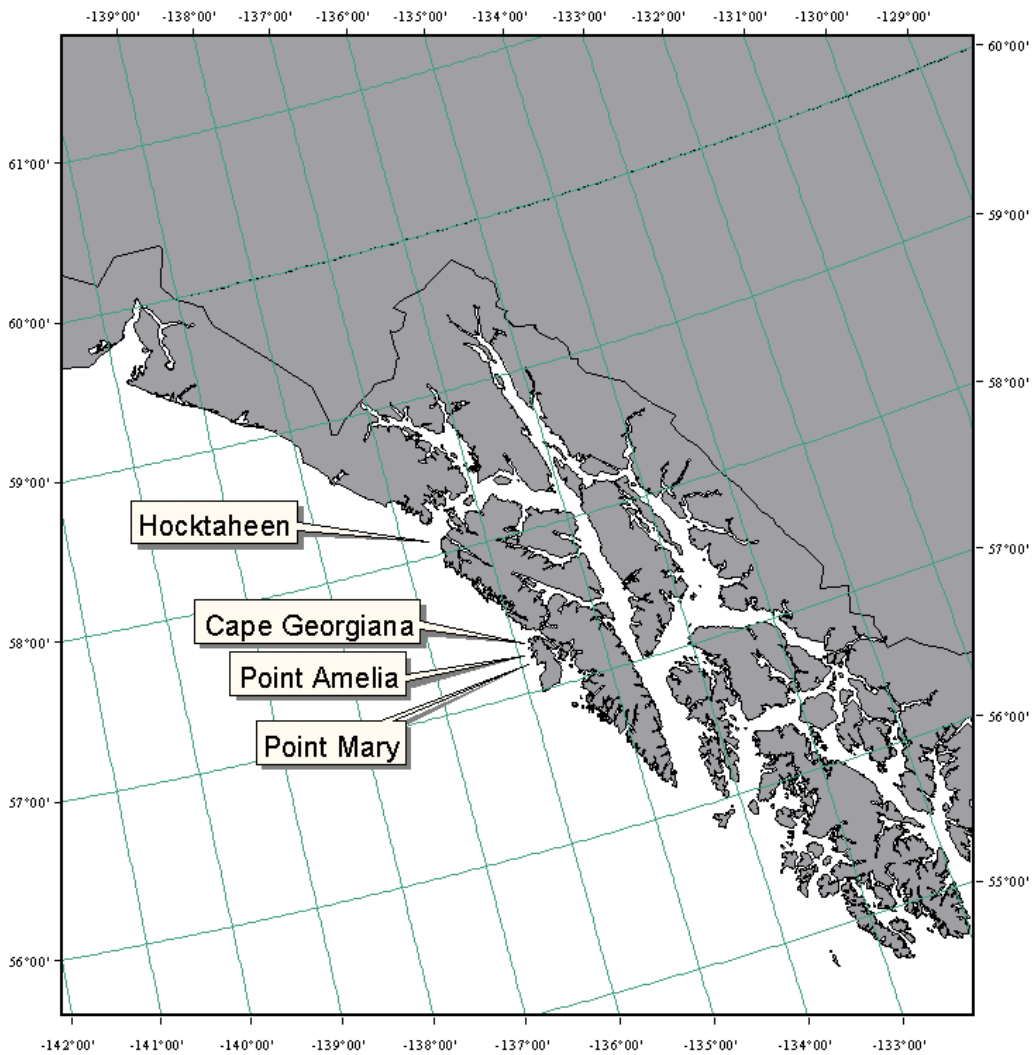


Figure 1.—Tag release locations during chinook salmon data storage tag surveys aboard the F/V *Shearwater* and the F/V *Tommy L II* in Southeast Alaska during May and June, 2002.

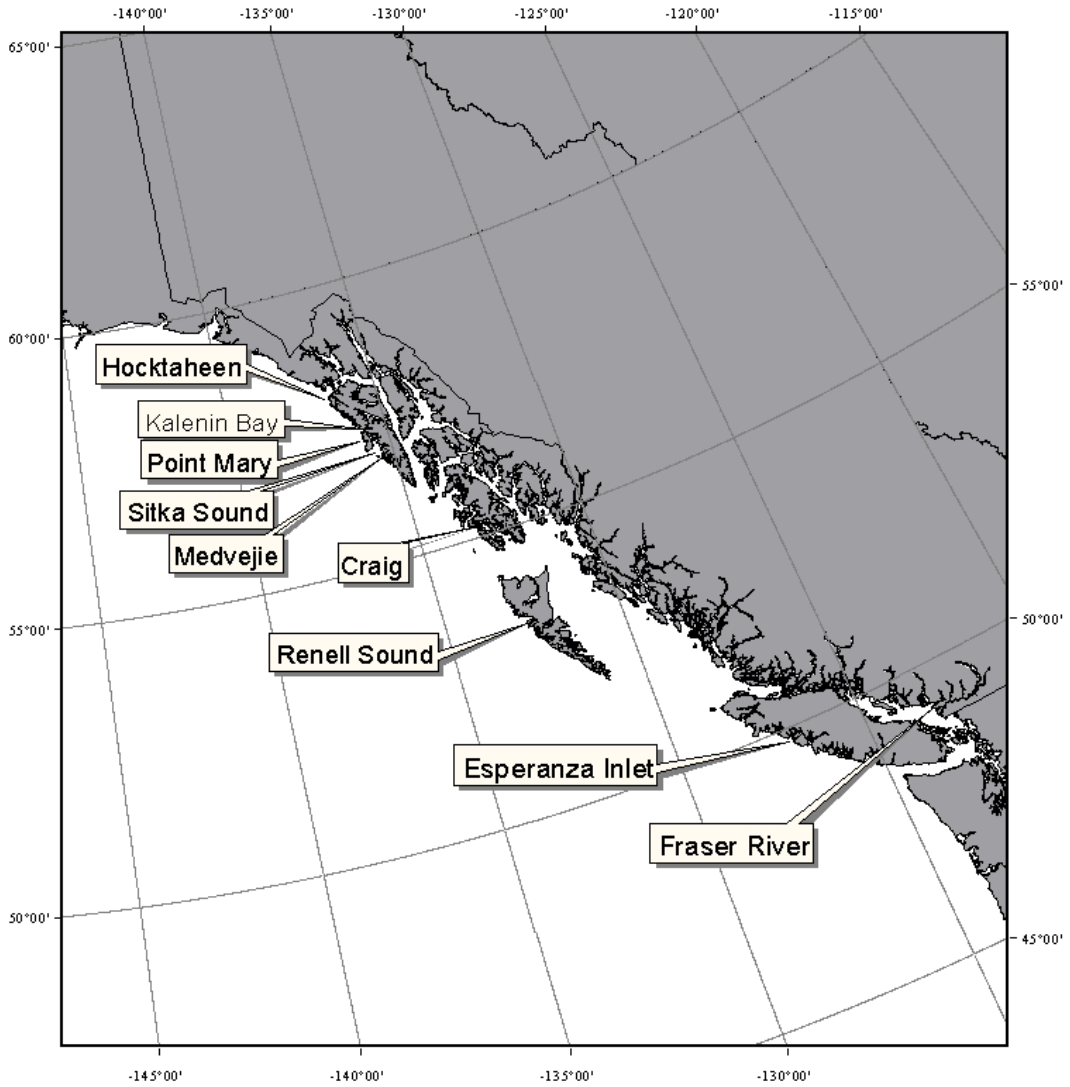


Figure 2.—Tag recovery locations from chinook salmon data storage tag surveys aboard The F/V Shearwater and the F/V *Tommy L II* in Southeast Alaska during May and June, 2002.

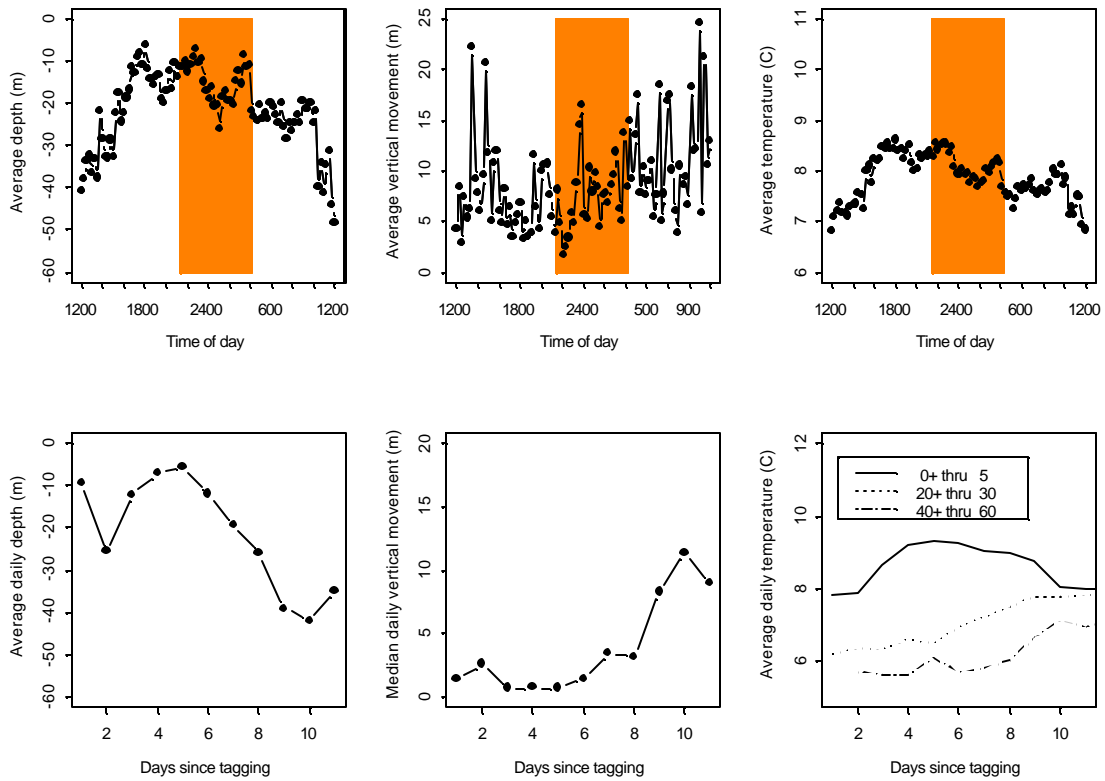


Figure 3.—Temperature and depth data from a chinook salmon tagged with a data-storage tag on May 21 and recovered on June 2, 2002 (tag number 21). Sunset and sunrise time periods are identified in the top three graphs (daylight hours are unshaded). Data shown are average 24hr depth, vertical movement, and temperature, and average daily depth, vertical movement and temperature at three depth strata (surface, 25 m, and 50 m).

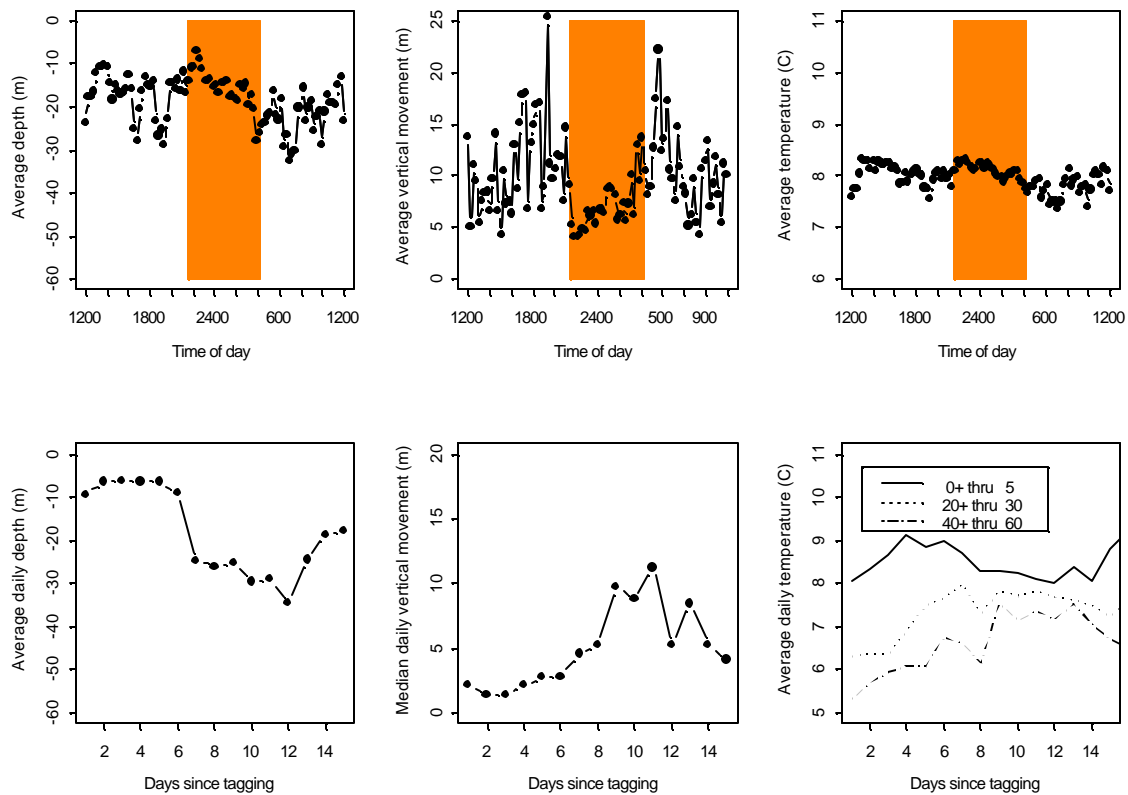


Figure 4.—Temperature and depth data from a chinook salmon tagged with a data-storage tag on May 22 and recovered on June 8, 2002 (tag number 34). Sunset and sunrise time periods are identified in the top three graphs (daylight hours are unshaded). Data shown are average 24hr depth, vertical movement, and temperature, and average daily depth, vertical movement and temperature at three depth strata (surface, 25 m, and 50 m).

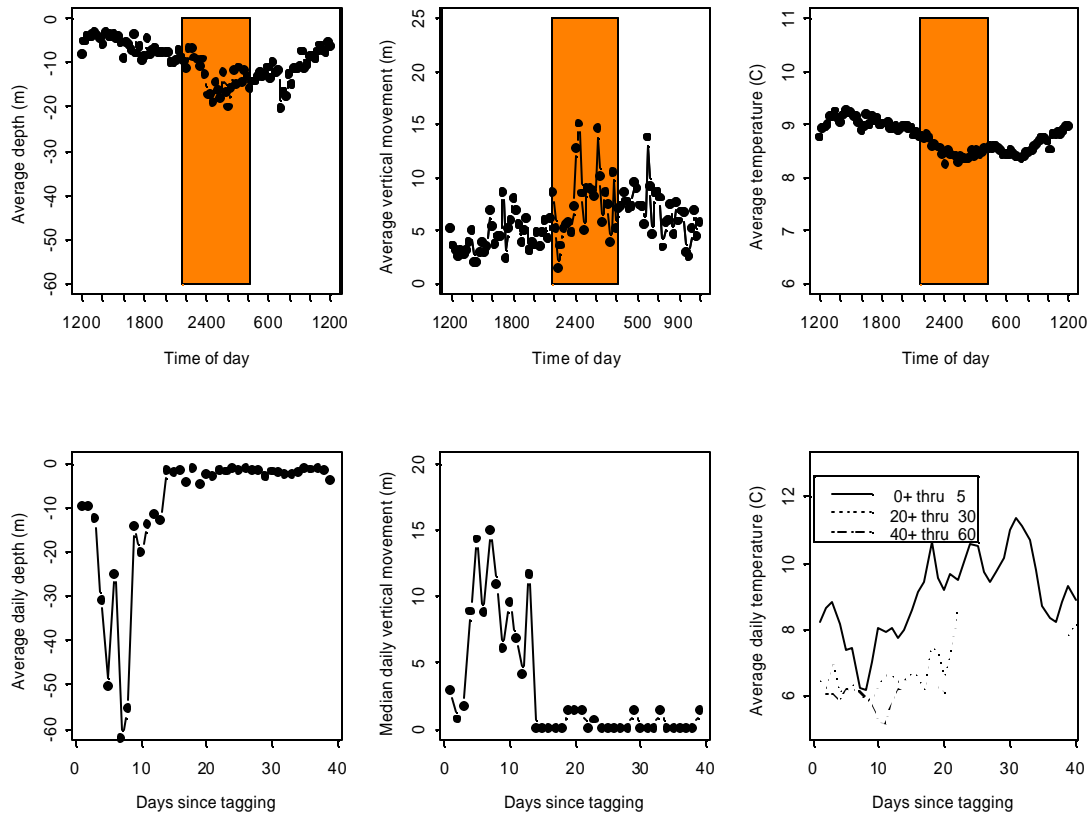


Figure 5. —Temperature and depth data from a chinook salmon tagged with a data-storage tag on May 22 and recovered on June 30, 2002 (tag number 54). Sunset and sunrise time periods are identified in the top three graphs (daylight hours are unshaded). Data shown are average 24hr depth, vertical movement, and temperature, and average daily depth, vertical movement and temperature at three depth strata (surface, 25 m, and 50 m).

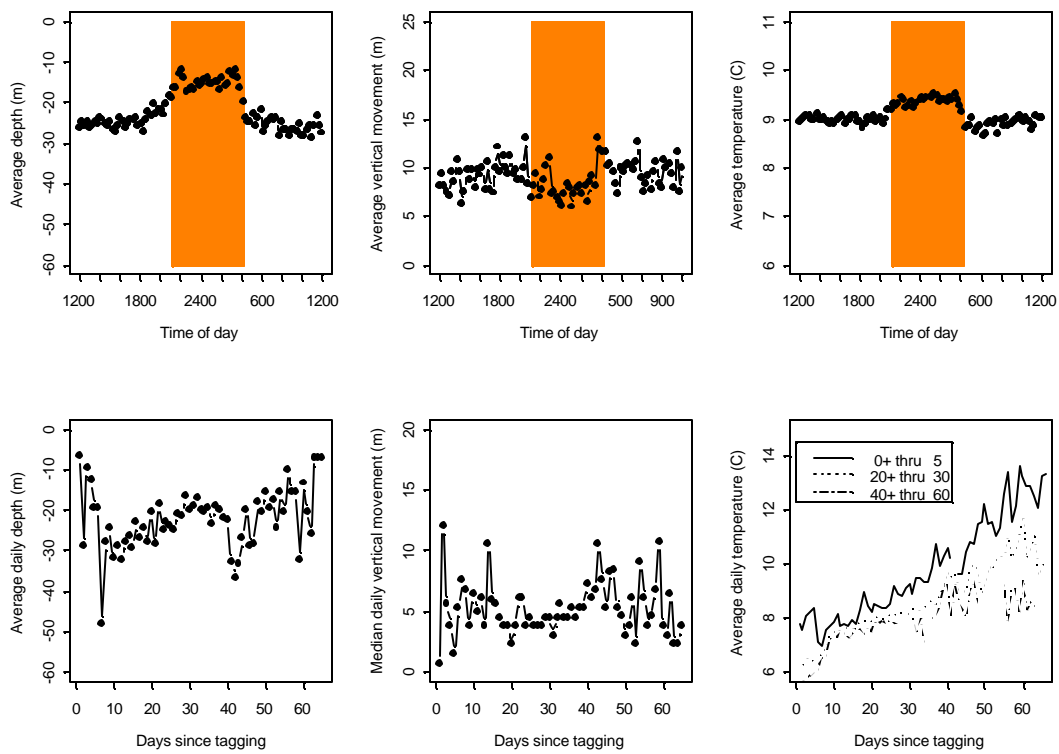


Figure 6.—Temperature and depth data from a chinook salmon tagged with a data-storage tag on May 20 and recovered on July 25, 2002 (tag number 1348). Sunset and sunrise time periods are identified in the top three graphs (daylight hours are unshaded). Data shown are average 24hr depth, vertical movement, and temperature, and average daily depth, vertical movement and temperature at three depth strata (surface, 25 m, and 50 m).

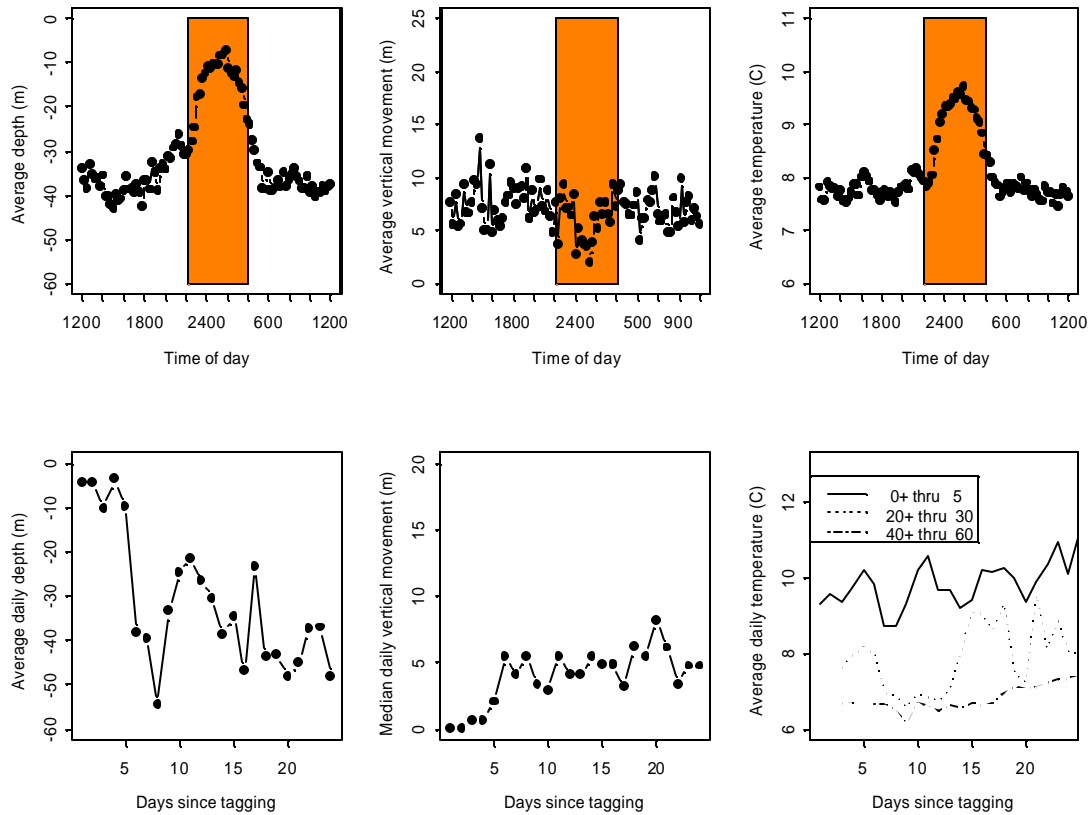


Figure 7. —Temperature and depth data from a chinook salmon tagged with a data-storage tag on June 11 and recovered on July 7, 2002 (tag number 188). Sunset and sunrise time periods are identified in the top three graphs (daylight hours are unshaded). Data shown are average 24hr depth, vertical movement, and temperature, and average daily depth, vertical movement and temperature at three depth strata (surface, 25 m, and 50 m).

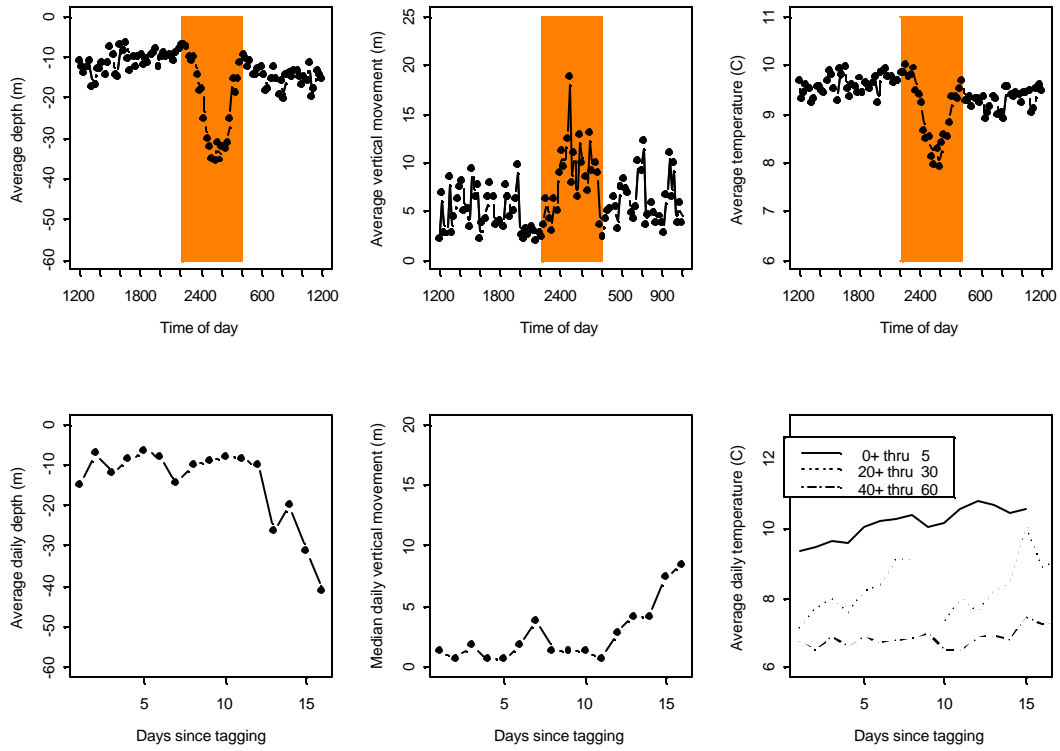


Figure 8. —Temperature and depth data from a chinook salmon tagged with a data-storage tag on June 11 and recovered on June 29, 2002 (tag number 1396). Sunset and sunrise time periods are identified in the top three graphs (daylight hours are unshaded). Data shown are average 24hr depth, vertical movement, and temperature, and average daily depth, vertical movement and temperature at three depth strata (surface, 25 m, and 50 m).

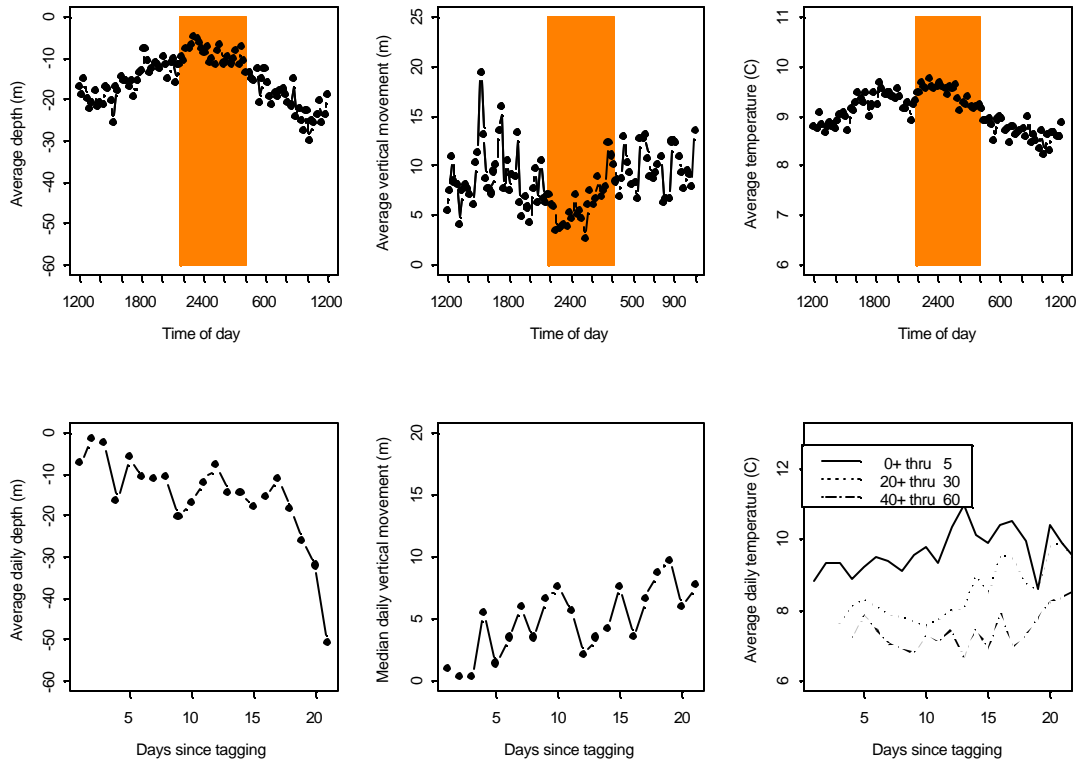


Figure 9. —Temperature and depth data from a chinook salmon tagged with a data-storage tag on June 11 and recovered on July 3, 2002 (tag number 941). Sunset and sunrise time periods are identified in the top three graphs (daylight hours are unshaded). Data shown are average 24hr depth, vertical movement, and temperature, and average daily depth, vertical movement and temperature at three depth strata (surface, 25 m, and 50 m).

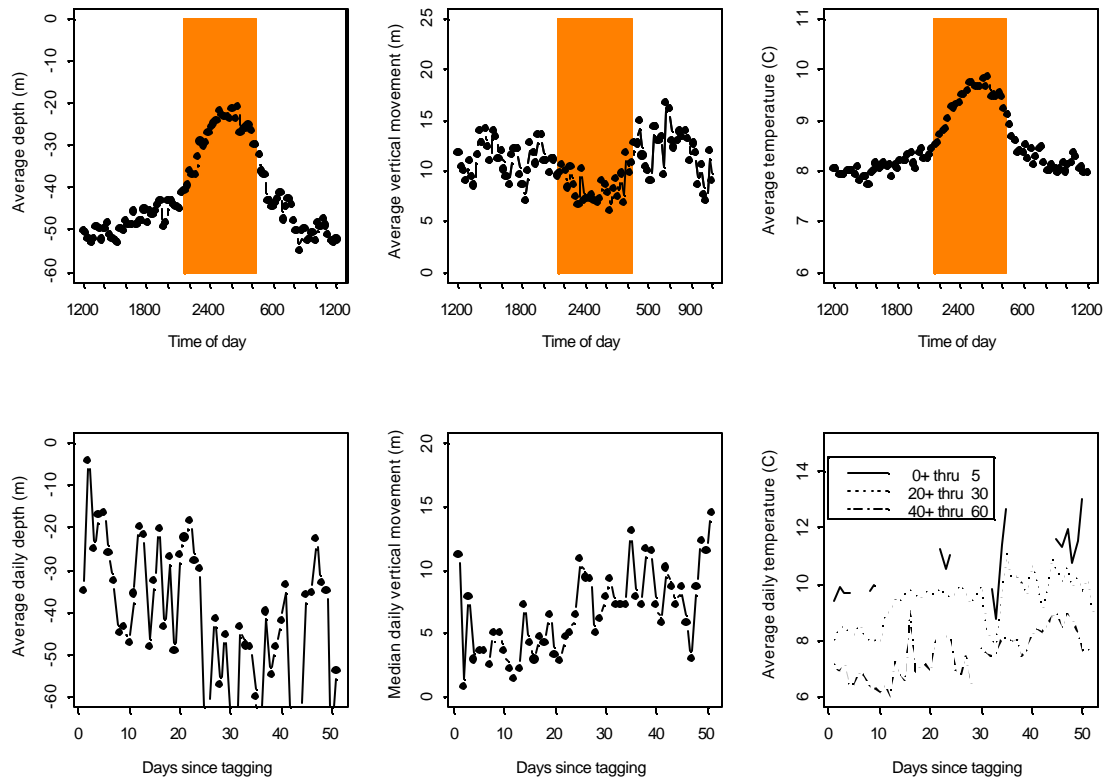


Figure 10. —Temperature and depth data from a chinook salmon tagged with a data-storage tag on June 11 and recovered on August 3, 2002 (tag number 1603). Sunset and sunrise time periods are identified in the top three graphs (daylight hours are unshaded). Data shown are average 24hr depth, vertical movement, and temperature, and average daily depth, vertical movement and temperature at three depth strata (surface, 25 m, and 50 m).

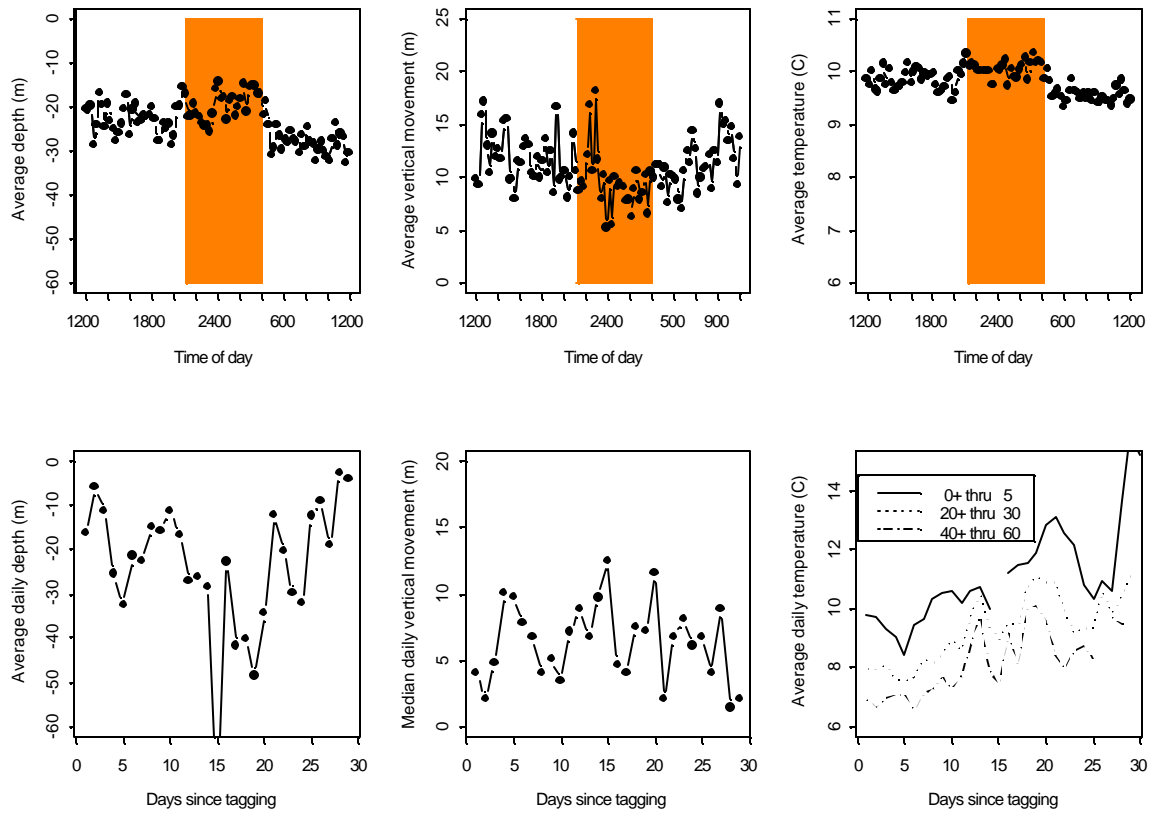


Figure 11. —Temperature and depth data from a chinook salmon tagged with a data-storage tag on June 11 and recovered on July 11, 2002 (tag number 132). Sunset and sunrise time periods are identified in the top three graphs (daylight hours are unshaded). Data shown are average 24hr depth, vertical movement, and temperature, and average daily depth, vertical movement and temperature at three depth strata (surface, 25 m, and 50 m).