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**Special setline experiments  
1985-1994 objectives, data  
formats, and collections**

by

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# Special setline experiments 1985-1994 objectives, data formats, and collections

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## **Abstract**

The International Pacific Halibut Commission conducts numerous special setline experiments, with designs intended to answer specific questions about the Pacific halibut resource. Often, these data are later accessed to try to answer questions other than those originally intended. In order to facilitate these possible investigations, this report attempts to describe and document the goals and designs, as well as the data formats, for the special experiments conducted between 1985 and 1994.

# Special setline experiments 1985-1994 objectives, data formats, and collections

Stephen M. Kaimmer

## Introduction

During the course of International Pacific Halibut Commission (IPHC) field research, it is frequently necessary to design special experiments; ones that are usually one-off, designed and executed to answer specific questions or address specific problems. Due to the nature of these special experiments, some of the data collected do not fit into the standard IPHC data structure, and it is necessary to either modify existing data structure, or even to create a totally unique data structure, to accommodate an experimental design. The purpose of this report is to document the data structures used in these special experiments, to facilitate their use by later researchers.

## IPHC setline data

Data from IPHC vessel charters are recorded on a series of data forms. The primary data forms used on all experiments are setline header forms, which contain descriptive information about each set of gear, and setline halibut forms, which contain descriptive information about each halibut caught. The setline halibut form, especially, has evolved to accommodate special data structures with two miscellaneous columns (“misc1” and “misc2”) that may be user defined for special experiments. The fields used currently in these forms are given in Appendix I. Over time, and with special needs of some experiments, the setline forms have been modified to include added information for special projects. Very occasionally, a special form has been created to archive special data collections that did not fit into the format of the general forms. In this report, it is assumed the reader has a familiarity with the standard IPHC data forms and structures. Examples of the setline header form “setformA” and the setline halibut form “setform B” are shown in Appendices II and III, respectively.

## Project types and presentation within this report

The projects conducted by the IPHC are varied in both type and duration. In order to add some order to this presentation, projects are grouped into one of three study types; gear and technology, bycatch, and biological and special stock assessment. Within each of these categories, projects are presented chronologically. Many of the projects conducted by the IPHC are single year, being completed within one field season. However, the IPHC has conducted a number of multi-year projects, i.e., projects where one or more different types of surveys, linked by the overall experimental purpose, were conducted over multiple years. Often, these ‘linked’ projects share special data formats or, in the case of the hook timer or underwater video projects, special data files. For clarity, these multi-year projects are presented in the year in which that project was started, with subheadings for each year’s efforts.

This report focuses on the objectives, results, data formats, and caveats for each experiment. For each experiment, the listing will first uniquely identify the effort, including vessel name(s), trip, and set numbers. This will be followed by a short version of the experimental objectives,

and then a description of unique data formats or data codes used in the experiment. For some experiments, set numbers are listed for both “prospecting” and “experiment” sets. Prospecting sets are those where gear is being set to identify areas with catch rates appropriate for the experimental design.

The final listing for each project is titled “Products”, indicating the reports which have been written describing or using data from the listed experiment. Most of these projects have been mentioned, if only briefly, in the Commission’s Annual Report series. These references are not included in the listing of reports by experiment. However, more detailed reports are usually included in the Stock Assessment Document (prior to 1990), Report of Commission Activities (1991), and Report of Assessment and Research Activities (“RARA”, subsequent to 1991), or in a separate report on the experiment.

## Gear experiments

### 1985-1988 Hook spacing and hook size

A variety of hook sizes and spacings have been used by the commercial halibut fleet. Over the years, a variety of experiments have been conducted to better understand the effects of these gear variations on halibut catch. Hook spacing or gear type experiments were conducted in 1985, 1987, and 1988.

#### *1985 Circle-hook hook spacing experiment*

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##### *F/V Chelsea*

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Experiment Areas	3A - East of Kodiak Island between Albatross and Portlock Banks
Charter Dates	August 23 to August 31
Trip Number	3
Set Numbers	98-151

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##### *F/V Star Wars II*

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Experiment Areas	2B – Carpenter Bay and north of Cape Scott
Charter Dates	June 26 to July 4
Trip Number	3
Set Numbers	81-134

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The purpose of this experiment was to obtain data to compare the catch per unit effort (CPUE) of standard halibut gear using circle hooks spaced at three different intervals. The secondary goal of the experiment was to study the local depletion of halibut by repeatedly fishing the same location.

Hook spacing experiments were conducted in IPHC Regulatory Areas 2B and 3A. Area 3A data are uniquely identified by selecting for set numbers 98-151 and vessel *F/V Chelsea* (“CHE”), and Area 2B data are identifiable by set numbers 81-134 and vessel *F/V Star Wars II* (“STW”).

Each string of gear was comprised of one of the following hook spacings: 13-, 21-, or 26-foot gear. The “hkspc” column identifies daily treatments, with two sets daily for each hook spacing. Stations were designated by a five character alphanumeric code that spanned both the “stnno” and the “stnpos” fields (Table 1). The first three characters were numeric in the station number field; the first was always “9” identifying the experiment as hook spacing, the second was 1-3 indicating the repetition, and the third was 1-6 indicating berth position. The fourth and fifth characters were alphabetic in the station position field; the fourth was A-E to distinguish

**Table 1. Station data formats used in 1985 C-hook hook spacing experiment.**

Digit	Field	Value(s)	Interpretation
First	Station number	9	To identify hook spacing experiment
Second	Station number	1, 2, or 3	For first, second, or third repetition of the fishing effort
Third	Station number	1, 2, 3, 4, 5, or 6	Berthing position within a day's set of gear, numbered from west to east.
Fourth	Station position	A, B, C, D, E, or F	Location of day's fishing. Three different fishing locations were fished in each of Areas 2B (A, B, and C) and 3A (D, E, and F).
Fifth	Station position	H or K	Identifying IPHC Regulatory Area where fishing took place; H for Hecate (2B) and K for Kodiak (3A)

between sample sets, and the last character was either H (Hecate) for sets in IPHC Regulatory Area 2B, or K (Kodiak) for Area 3A. For example 925BK meant hook spacing experiment, 2<sup>nd</sup> repetition of the 5<sup>th</sup> berth position in sample set B in the Kodiak area.

**Products:** Problems with missing data within the dataset prevented completion of the analysis. The only documentation of this effort was a very short report in the IPHC Stock Assessment document for 1986 (Kaimmer 1986) and a bit more involved summary in the 1985 Annual Report (IPHC 1986).

### *1987 Circle hook hook-spacing experiment in Area 3A*

#### *F/V Cape Flattery*

Experiment Area	3A – Kodiak Island area
Charter Dates	August 18 to August 27
Trip Number	3
Set Numbers	Prospecting 76-81, Experiment 82-117

Conducted in the Kodiak Island area of 3A, selecting sets 82 through 117 uniquely identifies these data. Six sets were fished each day, with each of three hook-spacings fished on two of each day's sets. Set positions were designated by a four-character alphanumeric code (Table 2). The first 3 characters were numeric; the first was always "9" identifying the experiment as experimental, the second was "2" to distinguish from the locations "0" and "1" fished during a 1987 depletion fishing experiment, and the third was 1-6 indicating berth position. The fourth character was alphabetic and designated as K for the Kodiak region of Area 3A. For example 925K designates the second location fished of the fifth berth position in the Kodiak area.

**Products:** No reports have been generated from this data.

**Table 2. Special data formats used in 1987 depletion and hook spacing fishing experiments.**

Digit	Field	Value(s)	Interpretation
First	Station number	9	To identify experimental
Second	Station number	0, 1, or 2	For first or second ("0" or "1") depletion fishing location within area or ("2") to distinguish hook spacing experiment.
Third	Station number	1, 2, 3, or 4	Berthing position within a day's set of gear.
Fourth	Station position	H or K	Identifying IPHC Regulatory Area where fishing took place; H for Hecate (2B) and K for Kodiak (3A)

## 1988 Halibut/sablefish gear comparison

### *F/V Cape Flattery*

Experiment Areas	3A – Yakutat and the south end of Kodiak Island
Charter Dates	August 15 to September 3
Trip Number	2
Set Numbers	Prospecting 46-49, 62-65, Experiment 50-61, 66-77

The experiment was designed to compare halibut catches on halibut and blackcod gear. Data from this experiment were to be used to determine a conversion factor between these two gear types. Unfortunately the experiment was not entirely successful due to poor weather.

Three different configurations of conventional fixed-hook setline gear were used. The first was halibut gear consisting of 1,500-foot skates of groundline with 16/0 circle hooks spaced at 18-foot intervals providing approximately 83 hooks per skate. The second was blackcod gear consisting of 700-foot skates of groundline with 14/0 circle hooks spaced at 3.5-foot intervals providing approximately 210 hooks per skate. The third configuration was intended as an intermediate between the first two and consisted of 700-foot skates of groundline with 14/0 hooks spaced at 18-foot intervals providing approximately 38 hooks per skate. During experimental fishing, 2 skates of blackcod gear (1,400 feet) were fished against 1 skate of halibut gear (1,500 feet) in order to make the ground covered comparable between the different gear types.

Stations were noted as XXX in the station number “stnno” field. The first character is “9” to signify an experimental station, the second character is either “1” or “2” representing the first or second run of the experiment in an area, and the third character is 1 through 6 representing berth position (Table 3). The experiment was conducted in two areas, Kodiak and Yakutat. The

**Table 3. Special data formats used in 1988 Halibut/sablefish gear comparison experiment.**

Digit	Field	Value(s)	Interpretation
First	Station number	9	To identify experimental
Second	Station number	1 or 2	For first or second run of the experiment.
Third	Station number	1, 2, 3, 4, 5, or 6	Berthing position within a day’s set of gear.
Fourth	Station position	Y or K	Identifying area where fishing took place; Y for Yakutat and K for Kodiak (both in Area 3A).

station position field distinguishes these areas as “K” and “Y”, respectively. Treatments can be distinguished using a combination of the hook type “hktyp” and the hook spacing “hkspc” fields. For hook type, a “4” was entered for the sablefish-size hooks, while “C” designated the larger halibut circle hooks. Hook spacing was entered as either 4 or 18. The hook size field was not used during this experiment.

**Products:** IPHC Stock Assessment Document (Kaimmer 1989a).

## 1987 Catchability trawl-setline experiment

### *F/V Snowfall*

Experiment Areas	2B – Cape Scott to Dixon Entrance, 3A – Northeast end of Kodiak Island
Charter Dates	May 22 to July 17
Trip Numbers	1-2
Set Numbers	1-54

From mid-May to mid-July of 1987, the trawler *Ocean Star* (“OCS”) and setline vessel *Snowfall* (“SNO”) were chartered to determine paired estimates of relative abundance and stock composition in the Queen Charlotte Islands region of Area 2B and the Kodiak region in Area 3A through a comparison of paired setline and trawl catches of halibut in both regions.

Stations were located at good fishing grounds in as many different sites and habitat types as possible, within each major area. This was to ensure that the catch ratio between the trawl and setline gear would be most representative of any difference which might exist between Areas 2B and 3A. Fishing locations were selected so that the trawl gear could be fished effectively, i.e., sites where the bottom was relatively smooth and regular.

Fifty-two locations were fished successfully; 25 in Area 2B and 27 in Area 3A. Fishing depth ranged from 18 to 104 fathoms with an average of 49 fathoms in Area 2B, and from 34 to 98 fathoms with an average of 61 fathoms in Area 3A. Each setline string, extending for approximately 2 nmi on the sea floor, was soaked for 85 to 105 minutes and was retrieved in an average of one hour and fifty minutes. The trawler fished for a distance of approximately 2 nmi at a distance of about one quarter nmi along each side of the setline. All halibut caught by both vessels were enumerated and measured, and weights were estimated from a length-weight relationship. On the setliner, approximately half the halibut were killed and the remaining halibut were tagged and released. All halibut caught on the trawler were measured and released well away from the next comparative tow, to make released fish unavailable for immediate recapture by the trawl gear.

Experiment stations were designated alphanumerically. The station number “stnno” is the same as the set number. The station position “stnpos” is either “H” for Hecate Strait in Area 2B or “K” for the Kodiak region in Area 3A. The same criteria are used for the trawler data, which allows trawler and setline catches to be matched.

**Products:** IPHC RARA document (Kaimmer, St-Pierre, and Smith 1988) and IPHC Scientific report (Kaimmer and St-Pierre, 1993).

## Bycatch experiments

### 1986-1994 Hooking injury and mortality

Mortality studies have been conducted both on fish removed from large circle hooks as well as those removed from the smaller circle hooks more common in the Pacific cod and sablefish fisheries. All experiments essentially noted the removal method, hooking location and hook removal injuries. Fish were tagged and released and survival rates were estimated by comparing tag recovery rates between different injury groups. Mortality/survival studies were conducted on large circle hooks in 1986, and on smaller hooks in 1993, and 1994.

#### *1986 Hooking injury and mortality associated with release by hook strippers*

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*F/V Moriah*

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Experiment Area	3A – Off the northeast end of Kodiak Island
Charter Dates	September 1 to September 3
Trip Number	1
Set Numbers	1-9

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This experiment was conducted to investigate the effects of ‘hook strippers’ in the halibut fishery, in particular the halibut mortality caused by using these devices to remove sublegal-sized halibut which were then returned to the sea. A commercial vessel was chartered to catch halibut and remove half of the halibut from the hooks using their automated hook stripper and the other half by careful shaking. Hooking locations and hook removal injuries were noted, and

most fish were tagged and released. Tag recovery rates were used to estimate relative survival of the different injury groups.

Selecting for the vessel Moriah ("MRH") from the stl\_hdr table uniquely identifies data. tag releases may be selected by choosing for tag numbers greater than "1". Hooking location (Table 4) is recorded in the "injcode" field. Treatments and hook removal injuries are uniquely identified in the Remarks column of the stl\_hal records. The remarks data are in a three-character "XYY" format, where X identifies the method of removing the fish from the hook ("C" by hook stripper, and "R" by carefully shaking, Table 5), and "YY" identifies the hook removal injury (Table 6). Tag numbers "pritagno" are recorded for each tagged fish.

**Table 4. Hooking locations and codes used in the 1986, 1993, and 1994 hook removal studies.**

Code	Mnemonic	Description
1	LJ	Left (white) jaw or cheek
2	RJ	Right (dark) jaw or cheek
3	EYE	eye
4	RM	roof of mouth
5	PP	pharyngeal pads*
6	TO	tongue
7	JH	jig-head
8	JB	jig-body
9	NO	no apparent injury
0	UNK	unknown or unrecorded

\*The pharyngeal pads consist of two fleshy knobs located on either side of the throat and are covered with small teeth

**Table 5. Hook removal methods used in the 1986 hook removal studies.**

Code	Method	Description
R	Careful shaking	The fish are removed by catching and twisting the hook with the gaff; the hook is held upside down against the tension of the gangion which allows the fish to fall from the hook. Sometimes a careful 'shake' is needed to drop the fish from the hook.
C	Automated hook stripping	Automated removal by allowing the fish to be held on the horns of the hook stripper while the hook is torn from the fish as the groundline comes aboard.

**Table 6. Hook removal injuries and codes used in the 1986 hook removal study.**

Code	Description
NI	No injury noticeable
TL	Torn lip
TC	Torn cheek; hole in cheek only
SJ	Split jaw; lower jaw is split along midline
TJ	Torn jaw; jaw is torn on one side or other, little or no tearing in cheek area
CJ	Cheek and jaw; tear in cheek extending through jaw
TF	Torn face; torn through cheek and jaw as above but large flap of side of head is ripped or missing

There are a total of 2,366 halibut records. For the 2,099 halibut which were tagged, there are injury codes, primary tag numbers, and remarks data for each fish. Killed fish are noted by having no tag number, no injury code, and the comment “NO OTO” in the remarks column.

**Products:** Reports were issued in the IPHC Stock Assessment Document (Kaimmer 1987, 1989d, 1991). A final report was presented in a paper in Fisheries Research (Kaimmer 1994).

### *1993 Hooking mortality and bycatch survival*

*F/V Rebecca B*

Experiment Areas	3A - East of Kodiak Island and 3B – SW of Kodiak Island
Charter Dates	April 25 to May 8
Trip Number	1
Set Numbers	Autoline gear 1-10, 12-14, 16-19, 23, Conventional gear 11, 15, 19-22, Special 24

This was the first year of a two-year study used to investigate the handling mortality associated with different methods of releasing Pacific halibut from the smaller hooks commonly used with Pacific cod and sablefish longline gear. The study area extended from the shelf edge outside of Ugak Island (east of Kodiak Island) to the region around Chirikof Island (south and west of Kodiak Island). The four main objectives of the study were: 1) to determine mortality rates for different hook removal/handling methods using cod-style gear; 2) to evaluate the criteria used by NMFS observers which relate to halibut viability and, if possible, to develop criteria which can relate handling mortalities to some combination of condition factor, release methodology or hook removal injury; 3) to determine the feasibility of holding halibut on-board for time periods of 3 days or longer in order to determine short-term mortalities associated with different handling methods or injury types; and 4) to produce a video document summarizing early observations and highlighting handling methods and damage done by poor handling (i.e. crucifying at the roller).

Halibut were caught with autoline gear and with conventional (i.e., skate-bottom) setline gear and were removed from the hooks by one of four methods; careful release by shaking, automated release using a hook stripper, hook straightening, and gangion cutting (Table 7). Halibut length, hook removal method, hooking location, hook removal injury (Table 8), and a condition code (Table 9) were recorded for each halibut. Halibut were then tagged and released.

**Table 7. Hook removal methods used in the 1993 and 1994 hook removal studies.**

Code	Method	Description
S	Careful shaking	The fish are removed by catching and twisting the hook with the gaff; the hook is held upside down against the tension of the gangion which allows the fish to fall from the hook. Sometimes a careful ‘shake’ is needed to drop the fish from the hook.
H	Hook straightening	The gaff holds the bend of the hook against the roller until it is straightened, pulling out of the fish.
G	Gangion cutting	The gangion is cut between the hook and the groundline, resulting in release with the hook still embedded in the fish.
C	Automated hook stripping	Automated removal by allowing the fish to be held on the horns of the hook stripper while the hook is torn from the fish as the groundline comes aboard.

**Table 8. Hook removal injuries and codes in order of increasing apparent severity used during 1993 and 1994.**

Severity	Code	Description
Minor	NI	No apparent injury
	CO	Cheek only; point of hook partially penetrates the cheek
	JO	Jaw only; point of hook partially penetrates the jaw
	TL	Torn lip
	TC	Torn cheek; small hole through cheek only
Moderate	TJ	Torn jaw; jaw is torn on one side or other, little or no tearing in cheek area
	CJ	Cheek and jaw; tear in cheek extending through jaw
	EYE	Hook penetrates eye
Severe	TF	Torn face; torn through cheek and jaw as above but large flap of side of head is ripped or missing
	SJ	Split jaw: lower jaw is split laterally
	JB	Jig body; fish was snagged by hook somewhere on body other than head
	JH	Jig head; as above but snagged in head area
	TS	Torn snout; upper jaw is split laterally, usually tearing through snout as well
	UN	Unknown or unrecorded

**Table 9. Condition codes used in 1993 and 1994 to assess halibut vitality.**

Code	Description	Criteria
E	Excellent, no sign of stress	Hook injuries are minor (limited to hook entrance/exit hole, torn lip) and located in jaw or cheek. Bleeding, if present, is minor and limited to jaw area. No penetration of the body by sand fleas (check eyes, fins, anus). Muscle tone or physical activity is strong. Gills are deep red
P	Poor, alive but showing signs of stress	Hook injuries may be severe: broken jaw; punctured eye. Vital organs are not injured. Bleeding may be moderate but not from gills. No penetration of the body by sand fleas (check eyes, fins, anus). Muscle tone or physical movement may be weak or intermittent; little, if any, response to stimuli. Gills are red.
D	Dead, no sign of life or, if alive, likely to die from severe injuries or suffocation	Vital organs may be damaged: torn gills; gaff wound to head or body; jig injury to viscera; side of face torn loose or missing jaw. Sand fleas have penetrated the body (they usually attack the eyes first, but also fins and anus). Severe bleeding may occur, especially from the gills. No sign of muscle tone; physical activity absent or limited to fin ripples or twitches. Gills may be red, pink, or white.

The RARA report for this pilot has cautions regarding recorded fish lengths and loss of fish at the roller. This report should be consulted before any attempt to use data from this experiment for either catch rate or fish growth calculations.

The cruise was a success both as a pilot to develop a more rigorous program for 1993 and as a platform for tag releases in 1994.

Selecting for the vessel *F/V Rebecca B* ('REB') and '1993' from the `stl_hdr` table uniquely identifies this data set. Hook removal methods are recorded in the "Misc1" column of the `stl_hal` records, while hook removal injuries are recorded in the "Misc2" column. The hook removal injury codes were expanded from those used in the 1986 study to allow more distinction between less severe injuries. Tag releases may be selected by choosing for tag numbers greater than "1". For the 3,783 halibut which were tagged, there are injury codes, primary tag numbers, and remarks data for each fish. Killed fish are noted by having no tag number, no injury code, and the comment "NO OTO" in the remarks column.

**Products:** IPHC RARA report (Kaimmer, Trumble, and Geernaert 1994).

### *1994 Hooking mortality and bycatch survival*

#### *F/V Rebecca B*

Experiment Areas	3A - Albatross Bank
Charter Dates	July 3 to July 29
Trip Numbers	1-3
Set Numbers	1-60

This project used gear and techniques typical of the longline fisheries for Pacific cod and sablefish, and was the second year of this study. The only change in fishing gear between 1993 and 1994 was in the method used to fish the 'autoline' gear. The chartered vessel used a Mustad autoline system ('automatic' baiting during setting, and racking during hauling) during the 1993 charter. The autoline system was removed after the 1993 charter, and during 1994, this gear was hand baited and coiled.

With 9,296 total tag releases, approximately equal numbers of fish were removed by each of the careful release methods, except with about twice the number released using the hook stripper. The 1994 releases were from a relatively small geographic area, extending 50 nmi along the coastal edge and shelf.

Tag recovery rates from this study were used to estimate relative survival probabilities for fish released by the different handling methods.

**Products:** IPHC RARA report (Kaimmer and Trumble 1995) and various papers and published proceedings (Kaimmer and Trumble 1997, 1998; Trumble 1996; Trumble, Kaimmer, and Williams 2000, 2001).

## **Biological and special stock assessment experiments**

### **1985-1988 Fishing ground depletion**

In ideal circumstances, the changes in daily catch resulting from continued removal of fish from a small ground should give information about the stock being fished. This 'depletion' fishing has been conducted on various grounds by the IPHC over the years. Often, this is combined with some other investigation, such as hook spacing or tagging. Depletion fishing experiments were conducted in 1985 in conjunction with hook spacing experiments, in 1987 as a stand-alone experiment, and 1988 in conjunction with tagging experiments. The 1985 experiment is reported under Gear Experiments.

## *Depletion fishing*

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### *F/V Cape Flattery*

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Experiment Areas	2B - Hecate Strait, 3A - the north end of Kodiak Island
Charter Dates	July 16 to August 14
Trip Numbers	1-2
Set Numbers	Prospecting 1-5, 38-40, 53-58, 71-75, Experiment 6-37, 41-52, 59-70

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This experiment was conducted to study the decline in catch rate as fish were removed from a small, localized fishing area. There were two vessel trips, one on British Columbia grounds in Area 2B and one on Kodiak grounds in Area 3A. For the experiment, four closely spaced sets of gear were fished daily in an effort to observe changes in catch from day to day. One location was fished during the 2B trip and two locations during the 3A trip.

Each day at any given location, the same starting and ending positions were used for each of four sets, and set locations were uniquely identified with four character station numbers (“stnno”), 9X1-9X4, where “X” is either 0 for the first set of fishing locations in the area, or 1 for the second set of locations. The first character was always “9” identifying experimental and the third was 1-4 indicating berth position. The data are further noted by an alphabetic in “stnpos”, either H for the Hecate region, or K for the Kodiak region (Table 2). Null values for station number or station positions indicate a prospecting set.

Trip 1 was conducted in the Charlotte region of IPHC Area 2B from 7/19-7/26, for eight consecutive days. These stations are identified as 901-904. Each station fished daily.

Trip 2 was conducted in the Kodiak region of IPHC Area 3A. During Trip 2, from 8/6-8/8, a set of locations was fished for three consecutive days, using station identifications of 901-904. Then, from 8/11-8/13, another location was fished for three days. These latter stations are identified as 911-914. Bad weather was experienced throughout Trip 2, and the data from these trips were not considered suitable for depletion analysis.

This effort was considered to be a preliminary investigation of depletion fishing as a management research tool, and as such collected information on the change in catch rate over the fishing period, stock composition, and movement of fish into and out of the survey area.

**Products:** IPHC Stock Assessment document (Kaimmer and Deriso 1988).

## *1988 “Sitka spot” depletion fishing and tagging in Area 2B*

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### *F/V Snowfall*

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Experiment Area	2B - Dixon Entrance
Charter Dates	May 27 to June 24
Trip Number	1
Set Numbers	1-66

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### *F/V Cape Flattery*

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Experiment Area	2B - Dixon Entrance
Charter Dates	July 17 to July 27
Trip Number	1
Set Numbers	1-42

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There were two specified goals for this experiment. The first goal was to conduct an extensive tagging operation to track movement of halibut off the chosen fishing ground. The second goal was to examine the effect of continuous fishing on the abundance of halibut within a small area, with the hypothesis that if the area were isolated from other grounds, depletion of halibut would occur.

Each day, six sets of gear were berthed at about 1/4-mile intervals, and designated A through F. The berthing position was recorded in the station position data field “stnpos”. The station number “stnno” was incremented each time a berthing position was fished. Thus, the first days fishing saw all stations indicated as station number 1, berths A through F (Table 10). The second day’s fishing was indicated as station number 2, and so on. The *F/V Snowfall* fished each position 12 times. The *F/V Cape Flattery* fished each position nine times.

**Table 10. Special data formats used in 1988 depletion fishing experiment.**

Digit	Field	Value(s)	Interpretation
First	Station number	1 through 9	For repetition of berths at a location
Second	Station position	A through F	To identify berth position

Data can be uniquely selected from the setline header table by using set numbers 1-66 for the *Snowfall* and 1-42 for the *Cape Flattery*.

**Products:** An initial report was issued in the IPHC Stock Assessment Document (Kaimmer and St-Pierre 1989), and later a RARA document described tag release and recoveries from the experiment (Geernaert, Parma, St-Pierre and Kaimmer 1993). These were followed by an IPHC Technical Report (Geernaert and Trumble 2000).

### 1987 Bristol Bay nearshore survey

#### *F/V Valorous*

Experiment Area	4 - nearshore Bristol Bay
Charter Dates	July 23 to August 2
Trip Number	1
Set Numbers	1-44

#### *F/V Coral*

Experiment Area	4 - nearshore Bristol Bay
Charter Dates	July 27 to August 11
Trip Number	1
Set Numbers	1-10

#### *F/V Erica C*

Experiment Areas	4 - nearshore Bristol Bay
Charter Dates	July 27 to August 9
Trip Number	1
Set Numbers	1-17

The Commission conducted a survey of the near-shore halibut stocks of Bristol Bay in response to an industry proposal to allow halibut fishing in that area. Two small Dillingham vessels, the *F/V Coral* and *F/V Erica C*, were chartered to fish locations within 10 nmi of the mainland shore Cape Newenham to Cape Seniavin, while the larger Seattle-based *F/V Valorous* was chartered to fish the complete coastal area up to 20 miles off the coast. Fishing locations were chosen based on local knowledge. All vessels fished with snap-on gear. The *F/V Valorous* used 16/0 hooks at 21 foot intervals, while the *Coral* and *Erica C* mixed 16/0 and 14/0 hooks spaced at 24 to 36 foot intervals.

Data can be selected from the setline header table by specifying vessel name (“VAL”, “COR”, or “ERC”) and set number range.

**Products:** IPHC Stock Assessment Document (Gilroy and Hoag, 1988) and IPHC Technical Report (Gilroy and Hoag, 1993).

### 1987 Observer trip on cod-fishing vessel

<i>F/V Polaris</i>	
Experiment Areas	3A – Kodiak Island area
Dates	July 23 to August 3
Trip Number	1
Set Numbers	1-27

During 1987, the captain of the Seattle-based halibut schooner *F/V Polaris* invited a Commission observer on a fishing trip targetting Pacific cod (*Gadus macrocephalus*). The trip was expected to provide first-hand knowledge of halibut incidence in the Pacific cod fishery. Location information was recorded for each set. Station numbers were all entered as “999”.

**Products:** IPHC Stock Assessment Document (Williams 1988).

### 1988-1992 Otolith-fish weight collections

Otolith collections were conducted in 1988, 1989, and 1992. The primary interest in these collections was verification of the IPHC otolith weight-fish weight extrapolations.

#### *1988 Area 3A Otolith weight - fish weight experiment*

<i>F/V Polaris</i>	
Experiment Areas	3A – Kodiak Island area
Dates	July 17 to July 24
Trip Number	1
Set Numbers	1-16

This trip served two functions. First, there was an otolith weight-fish weight experiment. Second, the vessel served as a photography platform to gather film footage of halibut fishing for a movie documenting the first 100 years of the commercial fishery for Pacific halibut. For the first objective, fish lengths, sex information, and otoliths were collected from 989 halibut. Numbered tags were attached to the fish following dressing at sea. Dressed and washed fish weights were obtained during the subsequent fish delivery process. The 4-character tag number was entered into the Remarks column on the setline halibut record. The matching file of tag number and fish weight was not entered into the database, and appears to be lost.

**Products:** IPHC Stock Assessment Document (Kaimmer, 1989c).

### *1989 Area 3A and 3B Otolith weight - fish weight*

#### *F/V Chelsea*

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Experiment Areas	3A – Seward Gully to Albatross Grounds, 3B – Trinity Is. to Shumagin Islands
Charter Dates	June 1 to June 9 and August 16 to September 2
Trip Numbers	1-3
Set Numbers	1-38

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#### *F/V Ocean Viking*

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Experiment Areas	2B – Cape Scott to Dixon Entrance, 2C – South of Cape Muzon
Charter Dates	May 31 to June 25
Trip Numbers	1-2
Set Numbers	1-57

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Two vessels were chartered in the summer of 1988 to collect a large number of otoliths from fish of known sex and weight in order to investigate differences in the otolith weight/fish weight relationship between regions and sexes. This process was ultimately to update the standard method of weight estimation. All fish caught were used for the experiment, including all U32 halibut (i.e. halibut below the commercial legal size limit of 32 inches or 81.3 cm).

Halibut forklength was recorded to the nearest centimeter and recorded along with its corresponding skate number. After measurements were taken, the sex was recorded and the white-side otolith was collected. A numbered plastic disk was then attached to the tail with a nylon electrical tie. When the fish were sold, each was weighed individually after heading and washing (fish landed by the *Chelsea* in August were not washed). During the sale, the fish weight was recorded to the nearest 0.1 pound using the fish buyer's scales. During data entry, the weight information was entered into the 'halwt' field in the setline halibut table.

Mistakes in recording data, and broken and lost tail tags reduced the amount of usable data by another 19%. Movement of a tare weight on the scale during unloading reduced the usable data by another 2%. In total, usable data were obtained on about 5,100 of the 6,429 fish caught.

**Products:** IPHC RARA (Clark, Larsen, and Henchman, 1990).

### *1992 Area 3A, 3B, and 4 Otolith-fish weight experiment*

#### *F/V Kaare*

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Experiment Areas	3A, 3B and 4
Charter Dates	June 20 to Sept 17
Trip Numbers	1-7
Set Numbers	1-135

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This experiment was conducted as a continuation of earlier collections, and designed to extend further into the westward regions, including the Aleutian Islands and Bering Sea. Trip 1 fished in Area 4A, trip 2 in Area 4D, trip 3 in Areas 4D and 4C, trips 4 and 5 in Area 4B, trip 6 in Areas 3B and 3A, and trip 7 in Area 3A. As in previous fish weight experiments, fish were marked with a numbered disk around the tail, and weights were taken after heading and washing at the offload facilities. In the dataset, fish weights are entered in the "halwtg" field.

When the fish were sold, each was weighed individually after heading and washing (fish landed by the Chelsea in August were not washed). During the sale, the fish weight was recorded to the nearest 0.1 pound using the fish buyer's scales. Weight information was entered into the 'halwt' field in the setline halibut record.

**Products:** Results summarized in an IPHC RARA document (St-Pierre and Larsen, 1993)

### 1989 Oil spill survey

#### *F/V Royal Quarry*

Experiment Areas	3A – Blying Sound, Prince William Sound, and lower Cook Inlet
Charter Dates	April 26 to May 6
Trip Number	1
Set Numbers	1-65

Responding to the *Exxon Valdez* oil spill of March 24, 1989, the IPHC in cooperation with the National Marine Fisheries Service (Seattle), investigated possible impacts of the oil spill on the halibut habitat with some exploratory fishing in the spill area. The fishing gear, and all halibut caught were visually examined for effects of oil. Samples were taken from 400 fish for laboratory analysis.

**Products:** IPHC RARA report summarizing effort and results (Blood 1990).

### 1989 Coded-wire tag project

#### *F/V Donna*

Experiment Areas	2A – West of Newport, Oregon between Heceta Head and Cascade Head
Charter Dates	May 5 to June 8
Trip Numbers	1-6
Set Numbers	1-78

This experiment had two objectives: 1) determine the feasibility of using mark-recapture coded-wire tag (CWT) techniques for assessing halibut population size; and 2) examine the dynamics of the fishery and the behavior of the halibut population to gain insight on how these factors influence interpretations of stock dynamics. In addition to a standard external tag, each legal-sized fish was injected with a CWT microtag. The IPHC staff scanned for the microtags during subsequent commercial halibut openings in 1989 and 1990.

Between three and four strings were set each day, with either four or six skates in each string. The gear was usually set between 0700 and 1100 each morning and allowed to soak for around four hours before hauling began. Often, the gear was not set until later in the morning, but all gear was always aboard before midnight.

The sex of tagged fish was determined using St-Pierre's (1992) visual criteria for sex determination of live halibut, and is subject to some error, particularly in fish less than around 85 cm.

External tag numbers were recorded in the tag number column. Internal tags were recorded only to batch groupings; batches 1 through 53. Internal tag batch numbers were recorded in the remarks column of the setline halibut form.

**Products:** IPHC RARA report (Sullivan, Kaimmer, St-Pierre, and Geernaert 1990) describing the tagging effort, a follow-up report describing tag recoveries (Sullivan, Geernaert, St-Pierre, and Kaimmer 1992), and an IPHC Scientific Report analyzing project results (Sullivan, Geernaert, St-Pierre, and Kaimmer 1993).

### **1989-1994 Hook timer and underwater video project**

From 1989 to 1994 the IPHC staff conducted a series of experiments using hook timers and sometimes also with an underwater camera. The primary purpose of these experiments was to document the effect of competition by other species, particularly dogfish, on the catch characteristics of Pacific halibut. A secondary purpose was to learn more about halibut hooking behavior.

The combined hook timer and underwater camera experiments spanned five years. During the first part of this period, both the hook timer and camera system underwent sea trials and development. The first studies used borrowed equipment and provided valuable insights into what changes would be necessary to make these systems work within the parameters of the halibut longline fishery.

Hook timers about the size of a C-cell battery are small devices containing a clock mechanism, battery, and magnetic reed switch. The timers are attached to the gangion, between the hook and the groundline. When the hook is attacked with sufficient force, the time of the event is recorded. Hook timer experiments were conducted in 1989, 1991, and 1994. The first experiments in 1989 and 1990 revealed several problems with the design of the hook timers. For later experiments, the IPHC redesigned the hook timers to make them more suitable for use with bottom-tending longline gear.

An underwater camera was fixed to a large frame to allow real time observations of fish attacks on baited hooks. This system was used to confirm reliability and action of the hook timers, and to document halibut behavior around baited hooks. Underwater camera observations were conducted in 1990, 1991, and 1994. In 1990, a pilot deployment of an underwater camera system was deployed near Seattle, WA. In 1991, an improved system was deployed off the Queen Charlotte Islands area of British Columbia. The system now employed a custom cable which both supported and retrieved the camera system, while at the same time conducting video and control signals between the camera and the support vessel. As well, the camera was launched and retrieved using a custom-built winch system. In 1994, the IPHC conducted paired deployments of hooktimers and the underwater camera in Area 2B.

#### *1989 Hook timer experiment*

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##### *F/V Ocean Viking*

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Experiment Area	2B - Cape Scott to Nigei Island
Charter Dates	October 2 to October 11
Trip Number	3
Set Numbers	58-64

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The goals of the pilot experiment were to assess the suitability of a particular type of hook timer in enabling the IPHC to better understand the dynamics of halibut CPUE and the interactions of other species with the halibut gear. One of the primary tasks of this charter was to determine the proper release tension at which the magnet-plug should be set.

The pilot experiment was completed in waters north of Vancouver Island and provided some promising results as well as revealing several flaws in the hook timer design and methodology. One hundred hook timers were borrowed from the National Marine Fisheries Service in Honolulu where the timers were developed for longline studies of atoll fishes. A small screw allowed adjustment of the tension holding a magnet plug located in one end of the timer. This provided a variable, user-set, release mechanism.

Fishing was conducted for four consecutive days and only seven sets were completed. The total halibut catch consisted of 44 O32 halibut (i.e. halibut greater than or equal to the commercial legal size limit of 32 inches or 81.3 cm in length) and 41 U32 halibut. The vessel set either one or two strings per day of three skates each. The middle skate was rigged with the hook timers attached between the snaps and gangions. All hooks were carefully monitored as they were retrieved. The hook status and catch of all species were recorded by skate, along with an estimated weight of each bycatch species by set. For every hook timer, the following data were recorded; set time, haul time, timer status (Table 11), bait status (Table 12), and catch species and estimated weight. The fork length of every halibut caught was measured to the

**Table 11. Timer status codes used in the 1991 and 1994 hook timer studies.**

Code	Description
N	Not tripped
T	Tripped
J	Jammed
M	Malfunctioned

**Table 12. Bait status codes used in the 1991 and 1994 hook timer studies.**

Code	Description
P	Present
N	Nibbled
S	Skin only
M	Missing

nearest centimeter and recorded along with its corresponding skate number. The fish were then immediately released, except during the last set (no. 64) where several halibut were killed and the sex recorded as male, female, or unknown.

There were a lot of problems during this first hook timer pilot study, including timers not tripping when large fish had obviously been captured, and timers which had tripped when there was no apparent catch. The hook timer data from this effort was not entered into the IPHC database, although the effort and halibut catch is documented in IPHC setline header and setline halibut tables.

**Products:** A brief RARA report (Kaimmer 1990).

### *1990 Underwater video observation of halibut hooking behavior*

#### *F/V Golden Dolphin*

Experiment Area	2A - Puget Sound near Seattle
Charter Dates	July 19 and 20
Trip Number	1
Set Numbers	1-6

#### *F/V Clipper II*

Experiment Areas	2B – Near Ramsey Island and on the Carpenter Bay Grounds
Charter Dates	August 31 to September 13
Trip Number	1
Set Numbers	1-9

The objectives of these charters were to determine the feasibility of deploying this type of equipment for underwater observations and to determine the ratios between observed number of fish, number of hook attacks, and number of fish caught. The first trip was a pilot to see whether there were any fatal flaws in the gear design or procedures. Set and catch information from this effort was kept in a field logbook only, and not archived in an IPHC data format. The camera was deployed six times during the two days in Puget Sound and nine times during the 13 days in southern Hecate Strait. Subsequent to the first trip, but before the second, the camera gear was

used to observe fish behavior near trawls. The gear as shipped to the vessel for the second trip was non-operational. Field repairs allowed the camera to be deployed only nine times before a system failure occurred which was not field-repairable. The effort data from these sets was archived only in the IPHC setline header records. Hook timer data from the *Clipper II* trip was entered into a field data form that was later processed into the hook timer database, stlhooktimer (Table 13). A row was completed for each hook hauled, including hook number, set and haul times as recorded, bait status at hauling (Table 12), and species codes and either length of halibut or weight in pounds for other species. For hook timer skates, timer readings and timer status (Table 11) were also recorded. Catch data were not entered into the database.

**Table 13. Data file structures used to record individual hook timer information in the 1991 stlhooktimer and 1994 stlhooktimer2 datasets.**

Variable name	Variable description
stlkey	setline key
vslcde	vessel code
trpno	trip number
setno	set number
regcde	<sup>1</sup> IPHC regulatory area code
sktno	skate number
hkno	hook number (sequential within each set)
timset	time set for each hook
timhl	time haul for each hook
hktim	<sup>2</sup> clock reading on hook timer
tmstt	timer status
btstt	bait status
spcde	IPHC species code
hallen	length in cm of caught halibut
spwgt	weight of caught species in pounds
rem	remarks
sethr	<sup>1</sup> settime
rethr	<sup>1</sup> retrieval time
trphr	<sup>2</sup> trip time
attmin	<sup>1</sup> attack minutes
sokmin	<sup>1</sup> soak minutes
mon	month
day	day
yr	year

<sup>1</sup>Variable field not used during the 1991 experiment.

<sup>2</sup>As an elapsed time to the timer tripping event.

**Products:** Two IPHC RARA reports, one on using the hook timers to investigate the relationship between CPUE and fish density (Kaimmer et al. 1991), and one briefly documenting the underwater video surveys conducted in 1990 (Kaimmer and Williams 1991).

## 1991 Underwater video observation of halibut hooking behavior

### *F/V Clipper II*

Experiment Areas	2B – Near Ramsey Island and on the Carpenter Bay Grounds
Charter Dates	June 12 to June 23
Trip Number	1
Set Numbers	1-59

Specific objectives were: 1) record the behavior of halibut and other competing species towards baited hooks using an underwater video camera, and 2) observe the general conditions on the fishing ground such as species consuming baits, presence of scavengers, etc. The gear was deployed a total of 60 times in depths ranging from 9 to 96 fathoms. Fifty-four of the deployments resulted in usable hook observations.

**Table 14. Fields and descriptions used on Camera Observation Form during 1994 Clipper II charter.**

Field name	Description
Set	Set number
Clock	Time of day <sup>1</sup>
TapeNo.	Tape number
Feet	Tape counter in feet
Tcde	Tape counter in hours and minutes
Tim_on_bttm	Elapsed time on bottom prior to event <sup>2</sup>
Scode	Species code
Snum	Unique species number within species and set in order of appearance
CDE	Behavior code
Obs	First appearance of a unique individual <sup>3,4</sup>
Dir	Direction of appearance relative to current <sup>5</sup>
Lie	Lying on seafloor <sup>4</sup>
L_DIR	For lying fish, distance and direction relative to current to closest bait
Cvr	Lying on top of (“covering”) a bait <sup>4</sup>
Bite	Observed bite <sup>6</sup>
Stl	Bite resulting in a stolen bait <sup>4</sup>
Hk	Fish appears to be hooked <sup>4</sup>
Drt	Darting behavior <sup>4</sup>
Other	Other behavior
Hk_Num	Hook number
Tmr_Stat	Timer status
Size(cm)	Halibut length in cm
SzEst.?	Y(es) if length estimated
Circ?	Fish circling back on bait
Sz/loc	Relative location of fish when length estimated
Meas/sz	Length if fish actually caught and measured
Comments	Descriptive comments about operation or observed behavior

<sup>1</sup>When not recorded for a specific event, this datum was interpolated.

<sup>2</sup>This datum was calculated after completion of the charter.

<sup>3</sup>Fish which swam out of the viewing frame and then swam back into the frame were only considered the same individual when timing, direction, and size information all strongly suggested that the returning fish was the same as the one which had recently departed.

<sup>4</sup>These fields were constructed as a checklist. A “1” in these fields indicates presence of the behavior, a “1x” indicates a compromised behavior, and a “9” when a behavior was likely but not observed. These behaviors are also listed in the “CDE” data field.

<sup>5</sup>A numeric value 1 through 8.

<sup>6</sup>For “Bite” observations, bites are coded as bite (“b”), incomplete bite (“ib”), or compromised bite (“ibx”).

**Table 15. Fish behavior codes and descriptions used during 1994 underwater camera trip.**

<b>Code<sup>1</sup></b>	<b>Behavior</b>
OBS	Fish is initially observed
LP	Loop, swimming in a circular pattern
LIE	Lying on the seafloor, not swimming
IB	Incomplete bite
B	Bite
R	Rush, swimming quickly with the bait in the mouth
H	The fish is hooked
S	The bait is pulled or spit from the mouth
G	A small, grazing bite or nibble at the bait
A	Aggressive behavior towards another fish
Away	Fish leaves the viewing area

<sup>1</sup>Code was annotated with an added "x" if the experimental setup interfered with the behavior. For example, a fish might swim around the camera frame, wrapping the gangion with a resulting escape from the hook ("Awayx").

A "Camera Observation Form" was completed aboard the *Clipper II* while observations were being recorded (Table 14). Codes for fish behaviors are given in Table 15. Although successful in the sense of proving out the camera gear, only six interactions were observed between halibut and the observed hooks. The effort data from this charter are archived in the setline header records. This charter was a pilot, primarily to test gear operation, and the observation and catch data were not entered into the IPHC database.

**Products:** An IPHC RARA report summarizing the results of the charter (Kaimmer 1992).

### *1991 Hook timer experiment*

#### *F/V Trekkor II*

Experiment Area	2A – Near Bellingham, WA
Charter Dates	May 3 to May 4
Trip Numbers	1
Set Numbers	1-4

#### *F/V Ocean Viking*

Experiment Area	2B – East of Carpenter Bay
Charter Dates	May 30 to June 19
Trip Number	1
Set Numbers	1-45

#### *F/V Big Valley*

Experiment Area	3A – Albatross Grounds on the shelf edge south of Kodiak
Charter Dates	August 2 to August 12
Trip Number	1
Set Numbers	1-14

In late 1989, the IPHC commissioned the Applied Physics Laboratory at the University of Washington, Seattle, to design a more rugged hook timer appropriate for use on bottom-tending setline gear. Early in 1991, the *F/V Trekkor II* was chartered out of Bellingham, WA for a one-day test of these new hook timers. Four sets were completed and timer performance and species catch were recorded in the logbook only. The trip tested a variety of "O"-rings to arrive at one which would give a repeatable release tension of 4 to 6 pounds.

The first full experiment using the new hook timers began with the *F/V Ocean Viking* in IPHC Area 2B. The *Ocean Viking* set a total of 225 skates of gear in 45 strings and caught over 21,000 pounds of halibut. The second trip was by the *F/V Big Valley* which set 70 skates of gear in 14 strings and caught around 14,000 pounds of halibut.

A standard fishing day was comprised of setting two sets of gear in the morning and two in the afternoon. Each set was made up of five skates of snap-gear with only the middle (third) skate rigged with the hook timers. Between 75 and 90 timers were deployed in each set of gear. Sets were retrieved after a two to three hour soak time. Timers were rinsed after each set so as to minimize the surface effects of slime on "O"-rings and release tension. One of the two sets carried a device which recorded the depth at one-minute intervals while the companion set carried a "dummy" device which approximated the size and weight of the time/depth device. Baits that fell off the hooks during the setting process or were stolen by birds were identified by hook number and discarded from the analysis.

The *Big Valley* completed one trip south of Kodiak Island. Only 14 sets were completed in the first five days of the charter. The data from the *Big Valley*, while archived, should not be used in analyses because of problems with data quality and observations which indicated the grounds were not suitable for the experiment because of significant competition by Pacific cod and starfish.

For the year 1991, the stlhooktimer table contains 5,806 records from the *Big Valley* trip, 17,527 records from the *Ocean Viking* trip, and 229 records from the hook timers deployed with the camera gear on the *Clipper II*.

**Products:** IPHC RARA report on progress to date (Parma, Larsen, and Kaimmer 1992).

#### *1994 Underwater video/hook timer experiment*

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##### *F/V Clipper II*

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Experiment Area	2B - Queen Charlotte Islands
Charter Dates	June 6 to June 21
Trip Number	1
Set Numbers	1-45

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##### *F/V Ocean Viking*

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Experiment Area	2B - Queen Charlotte Islands
Charter Dates	June 9 to June 21
Trip Number	1
Set Numbers	1-32

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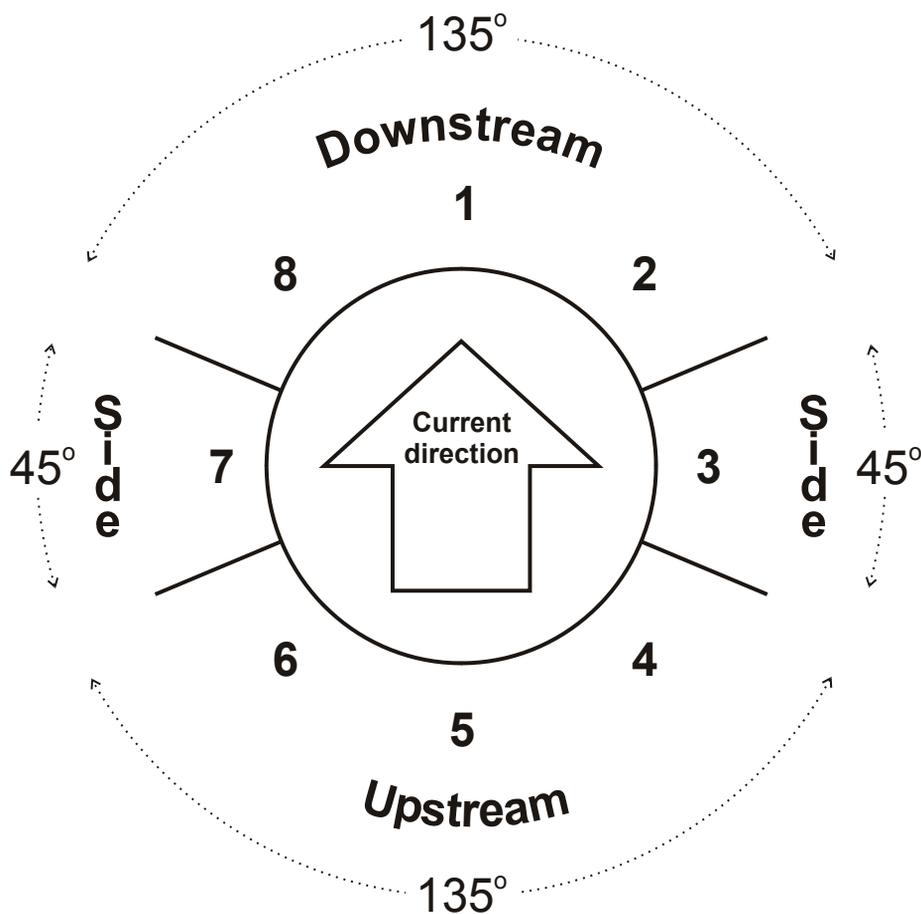
Two chartered vessels, the *Clipper II* and the *Ocean Viking*, worked together conducting a research experiment involving the use of hook timers and an underwater video camera in Area 2B around the Queen Charlotte Islands. This experiment was part of an ongoing project aimed at analyzing and modeling the longline fishing process with the purpose of evaluating the effect of bait competitors on the catch rate of halibut. The primary goals of the experiment were to

explore a few fishing grounds, and to collect information on the pattern of bait removals through time, the species composition of the catch, and the hooking success of the most common species competing for bait on those grounds. While the *Ocean Viking* fished longline gear with hook timers, the *Clipper II* deployed an underwater camera in the vicinity to observe the behavior different species exhibited toward a few baited hooks placed in the field of view of the camera.

The specific objective for the *Ocean Viking* was to fish with longline gear rigged with hook timers on one or two grounds in order to collect hook-by-hook information on the time elapsed until baits were attacked, and the outcome of the attacks (species caught or bait status). A total of 32 longline sets (142 skates) were made over nine days of fishing which resulted in a catch of legal halibut close to 14,000 pounds.

Setting information recorded during the *Ocean Viking* cruise included the position and depth of each set, and the orientation of the set with respect to current direction (Fig. 1) and weather conditions. Observations of the gear included set time for each skate, and time at set (minute by minute) for hooks on the hook-timer skate. Timers that tripped while setting and baits that fell off were identified by hook number.

The status of each hook was examined during haulback. Data recorded for each hook included the time of retrieval, bait status, and any bycatch species or halibut caught. Estimated weights were recorded individually for each bycatch species. In addition to these observations,



**Figure 1. Numeric codes for arrival or departure direction relative to prevailing current. Code "9" was used when behavior occurred during slack current. Code "99" was used when approach direction was not able to be determined.**

the middle (hook timer) skate was monitored for timer status and the reading on the clock was recorded. Stomach contents of as many halibut and dogfish as possible were examined and the number of fresh baits found was recorded.

Specific objectives for the *Clipper II* were to record the behavior of halibut and other competing species towards baited hooks on a few fishing grounds using an underwater video camera, and to observe any occurrences of interaction by other species with the gear, e.g. species consuming baits, presence of scavengers, etc. A total of 45 camera deployments were completed and over 40 hours of video were collected from these sets. A "Camera Observation Form" was completed aboard the *Clipper II* while observations were being recorded (Table 14). This form was completed as much as possible in the field. Codes for fish behaviors are given in Table 15. After completion of the charter, the video tapes were reviewed and further information was added. This further information included calculated fields such as the time it took for the hook to reach the seafloor, as well as more detailed behavioral observations which were missed or otherwise not recorded in the field. The header information for the set and a summary of hook status at retrieval were recorded on a Set Form A.

For the year 1994, the database table stlhooktimer2 contains 12,197 records from the *Ocean Viking* trip. The Camera observation table stlCameraObservations94 contains 1,859 records.

**Products:** IPHC RARA report in 1995 (Parma, Kaimmer, and Sullivan 1995), and a paper in Fisheries Bulletin published in 1999 (Kaimmer 1999).

## Acknowledgments

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## Appendix I.

**Table 1. Record structure of setline effort data in IPHC database seline header “stl\_header”.**

Field	Description
stlkey	setline record index
vsclde	setline vessel code
trpno	trip number
setno	set number
date	set date
year	set year
stnno	station number
stnpos	station position
stnmov	station relocated from design : temporary or permanent
prpcde	purpose of cruise
eff	effectiveness of set
lat	latitude
lon	longitude
statarea	statistical area
expno	experiment number
grcde	gear type
hktyp	hook type
hksze	hook size
hkspc	hook spacing
noskt	number of skates hauled
nolin	number of lines
nohk	number of hooks per skate
effskt	number of effective skates
hallgno	number of legal halibut
hallglwt	legal halibut net weight
halsubno	number of sublegal halibut
halsubwt	sublegal halibut net weight
sktset	number of skates set
mindep	minimum set depth - meters
maxdep	maximum set depth - meters
settime	time gear set
begtime	begin of gear retrieval
endtime	end of gear retrieval
bait	bait type used
bottmp	bottom temperature - celcius
srftmp	surface temperature - celcius
bad	type of bird avoidance device used
deckid	staff member on deck
shackid	staff member in shack
seastate	sea state - beaufort scale
notkey	link to note table
upddate	record modification date
verdate	record verification date

## Appendix I.

**Table 2. Record structure of setline halibut data in IPHC database setline halibut “stl\_halibut”.**

Field	Description
stlkey	setline record index
halkey	halibut record index
halseq	assigned record order number
sktno	skate number
frklen	fork length
hdlen	length of head of halibut
halwgt	halibut weight - pounds
injcd	injury code
tagtyp	tag type
tagno	tag number
cndcde	condition at time of release
matcde	maturity code
otono	otolith envelope number
sex	gender
rem	remarks
age	resolved age
misc1	data varies from year to year
misc2	data varies from year to year

**Appendix II.**

**SET SUMMARY FORM A**

Set	Vessel	Month	Day	Year	Trip Number	Station Number	Purp. Code	EFF.

N. Latitude		W. Longitude		Statistical Area	Depth (Fathoms)		Tag Experiment	Gear	Hook	Hook Sz
Degrees	Minutes	Degrees	Minutes		Maximum	Minimum				

No. of Skates	No. of Lines	Skate		Time Set	Time Hauled		Bait	Temperature	
		No. of Hooks	Hook Space		Start	Finish		Bottom	Surface

**Remarks:**

**Other Species Catch**

Species	Code	Catch in Numbers by Skate								Total Number	Ave. Weight
		1	2	3	4	5	6	7	8		
Missing Bait	300										

**Appendix III.**

**SET FORM B**

Set		Vessel		Month		Day		Year		Trip Number		Station Number			

**HALIBUT**

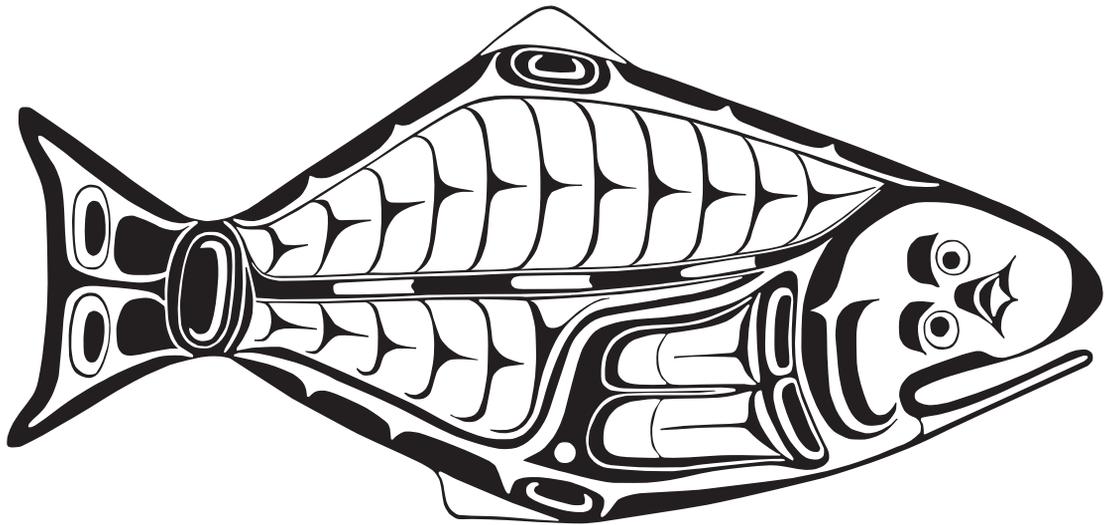
Page No.

Sk. No.	Total Length	Condition	Hk. inj.	Tag Number	Type	Envelope Number	Sex	Matur.	Misc. 1	Misc. 2	Remarks
1											
3											
5											
7											
9											
11											
13											
15											
17											
19											
21											
23											
25											

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*HALIBUT CREST - adapted from designs used by Tlingit, Tsimshian and Haida Indians.*

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