Appendix H
EFH EIS Methods of Data Analysis

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ACRONYMS AND ABBREVIATIONS

ABUN	a relative abundance estimate
ADF&G	Alaska Department of Fish and Game
AI	Aleutian Islands
AKFIN	Alaska Fisheries Information Network
CBV	Catch By Vessel
CIA-R	Catch-In-Areas with Redistribution
Council	North Pacific Fishery Management Council
CPUE	catch per unit effort
CUMULATED	a cumulated column
EBS	Bering Sea
EFH	essential fish habitat
FMP	Fishery Management Plan
GIS	geographic information system
GOA	Gulf of Alaska
m	meter
mt	metric tons
nm	nautical miles
NMFS	National Marine Fisheries Service
NORPAC	NMFS domestic groundfish observer program database
OTC	official total catch
NPT	nonpelagic trawl
PTR	pelagic trawl
SEIS	Supplemental EIS
sq. km	square kilometers
sq. m	square meters
StQ	status quo

H.1 Introduction

This appendix describes several methods and databases used in this analysis. In the following list, the key contact for each model or database is noted in parentheses.

- Fisheries Analysis: Database of Fisheries Catch-In-Areas with Redistribution and associated economic value [S. Lewis]
- Spatial Area Analysis [S. Lewis; C. Coon]
- Database for Catch and catch per unit effort (CPUE) of target fisheries inside and outside of essential fish habitat (EFH) restriction areas; also used for fisheries analysis under Aleutian Islands (AI) Alternative 5B [C. Coon]
- Methods used for finding the known concentrations and general distributions of species managed under the current Fishery Management Plan (FMP) [J. Olson]
- Creation of Alternative 5B [J. Olson]
- Alaska Fisheries Information Network's (AKFIN) methods for finding commercial harvest of crab, halibut, herring, and scallops by state statistical area [P. Murphy]
- Use of the AKFIN database in the community/social assessment

H.2 Purpose of Fisheries Analysis

The purpose of this fisheries analysis is to model fishery restrictions by gear type and probable target species (dominant species by haul target), as described by the North Pacific Fishery Management Council EFH Committee alternatives, and to assign a value to the associated catch placed at risk by the restrictions (catch-at-risk). The spatial resolution of the catch data was the state statistical area (described later), but because the alternatives' restrictions did not line up with these statistical areas, proportional allocation (with the exception of Alternative 5B in the Aleutian Islands [AI]) was used to assign catch in and out of areas. This analysis was limited to groundfish.

H.3 Creation of Geodatabase Feature Classes

The first step in the spatial fisheries analysis was integrating the spatial EFH fishing impact minimization measures developed by the EFH Committee into current closures and protection measures. The process involved creating a comprehensive status quo geodatabase (see Figure H-1 and Table H-1). A geodatabase is simply a database-ready version of a geographic information system (GIS) shapefile (a vector representation of a polygon or shape). Note that due to the complex nature of the closures, some smaller areas were not coded into the status quo.

The principal attributes of the status quo geodatabase represent restrictions on gear, season, target species, and/or other features. Each feature in the geodatabase includes the Alaska Department of Fish and Game (ADF&G) groundfish statistical area, the gear type it restricts, the probable target it restricts, the restriction start and end dates, and the polygon area in square meters. Since the management is highly complex, there are overlaps where, for instance, bottom trawl is restricted to all species but the area is also restricted to all trawling (pelagic and nonpelagic) for the Steller sea lion prey species—Atka mackerel, P. cod, and pollock.

Figure H-1. EFH Fishing Impact Minimization Alternative 3 - Status Quo

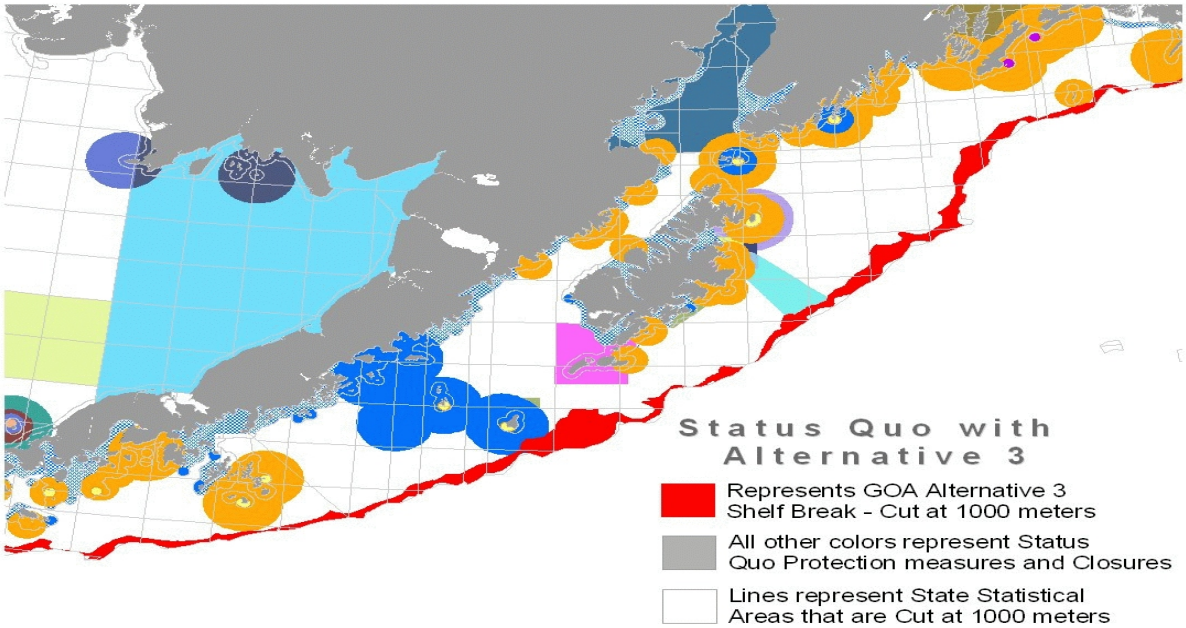


Table H-1. Contents of the Status Quo Geodatabase

What the Status Quo Geodatabase Includes	What the Status Quo Geodatabase Does Not Include
Red King Crab No Nonpelagic Trawl (NPT) Area (does not include limited open areas inside this area)	Bogoslof Pacific Cod Exempt Area
Near Shore Bristol Bay Area	Cape Peirce Walrus Protection Area
Pribilof Habitat Conservation Area	Bycatch limitation areas
Sitka Pinnacles	Partial year open area inside Near Shore Bristol Bay Area
Southeast No Trawl Area	
State Inshore No NPT Areas	
Gulf Type 1 and 2 Areas	
Steller Sea Lion Protection Measures 3nm No Transit Areas Hook and Line and Pot Closures Seasonal Closures Closed Foraging Areas Trawl Closures Atka Mackerel and P. Cod Harvest Limit Dependent Fisheries	

The design of the database ensures that catch is not double-counted by requiring that catch meets all of the following criteria: state statistical area of catch, gear type, probable target, and the start and end dates of the closure or protection measure. For instance, if the database has a catch record for a proportion of a

state statistical area, an "NPT" (for nonpelagic trawl), a "K" (for a probable target for Rockfish), and start and end dates of 0815 (August 15) and 0920 (September 20), the record will not be counted if the restriction was pelagic trawl (PTR), K, 0814, and 0901 because all the criteria did not match; in this case, the gear type was PTR rather than NPT.

The projection (how a flat map is projected on the Earth's surface) used in this analysis was the Alaska Albers equal-area conic projection using ArcGIS 8.3. Instead of shapefiles, the ESRI geodatabase was used throughout the process. The ESRI geodatabase is a database-ready version of a shapefile. The shape-area field in a geodatabase is a generated field, and the square meters calculation is updated as the topology is changed.

Each EFH fishing impact minimization alternative's spatial fisheries restrictions were then coded with their own similar attributes. The status quo geodatabase was merged with each EFH alternative shapefile. The final process of integration included manually changing the geodatabases' attributes to ensure that the EFH measures would not double-count restricted catch. The status quo was coded to always take precedence. For example, in the AI, where most of the EFH closures overlapped status quo closures, the EFH closures would count only the catch that was not already closed to other protection measures.

Seven base alternatives were identified. However, to account for the rotating closures, twelve alternatives were analyzed as described in Table H-2.

Table H-2. EFH Fishing Impact Minimization Alternatives Analyzed

DB Alt Name	Alternative	Gulf of Alaska (GOA)	Aleutian Islands (AI)	Bering Sea (EBS)
A1	Alternative 1	Status quo (StQ)	StQ	StQ
A2	Alternative 2	GOA Alt2 & StQ	StQ	StQ
A3	Alternative 3	GOA Alt3 & StQ	StQ	StQ
A4_A	Alternative 4	GOA Alt4 & StQ	AI Alt4 & StQ	EBS EFH Rot 4x -A & StQ
A4_B		GOA Alt4 & StQ	AI Alt4 & StQ	EBS EFH Rot 4x -B & StQ
A4_C		GOA Alt4 & StQ	AI Alt4 & StQ	EBS EFH Rot 4x -C & StQ
A4_D		GOA Alt4 & StQ	AI Alt4 & StQ	EBS EFH Rot 4x -D & StQ
A5a_A	Alternative 5A	GOA Alt5 & StQ	AI Alt5A & StQ	EBS EFH Rot 3x-A & StQ
A5a_B		GOA Alt5 & StQ	AI Alt5A & StQ	EBS EFH Rot 3x-B & StQ
A5a_C		GOA Alt5 & StQ	AI Alt5A & StQ	EBS EFH Rot 3x-C & StQ
A5b	Alternative 5B	GOA Alt5 StQ	AI Alt5B & StQ	StQ
A6	Alternative 6	Alt6 & StQ	Alt6 & StQ	Alt6 & StQ

StQ = Status Quo Spatial Measures: Steller Sea Lion Protection Measures and other No Trawl Areas
Alt = EFH fishing impact minimization alternative
Rot = Refers to Bering Sea EFH fishing impact minimization alternative rotating closures

H.4 Data Used

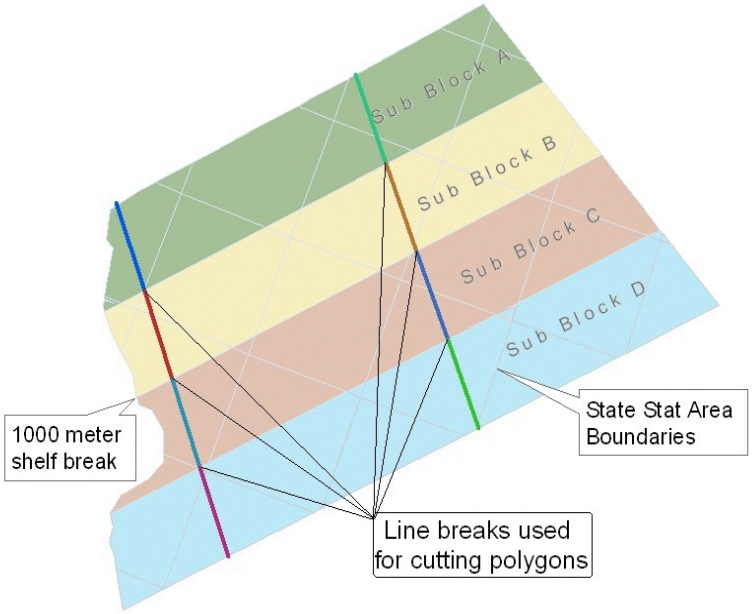
Fisheries data were limited to 2001 data for two main reasons: 1) ADF&G groundfish statistical areas changed in 2001, so analysis cannot span across this and prior years without many assumptions being made, and 2) 2002 fisheries catch data were not yet available at the time of analysis.

H.5 2001 Management Review

The November 2000 Biological Opinion for Steller sea lions was ruled arbitrary and capricious, so between January 1 and June 10, 2001, management reverted to the No-Trawl for Prey Species areas and Pollock Revised Final Reasonable and Prudent Alternatives from 2000. Between June 10 and July 17, 2001, the November 2000 Biological Opinion's reasonable and prudent alternatives open and closed districts were in place. Then from July 17 to the end of 2001, and to present (July 2003), the Steller Sea Lion Supplemental EIS (SEIS) closures were in place. Each of these three management scenarios is in addition to the fisheries management measures already in place, including legacy trawling restrictions and other various closures and bycatch restriction areas.

H.6 Rotating Closures

Figure H-2. Example of Bering Sea Rotating Closure



Alternatives 4, 5A, and 5B include rotating closures in the Northern Bering Sea. To create equal sized (sized perpendicular to EBS shelf break and not by square meters) rotating sub-blocks, two parallel lines were created inside and perpendicular to each block and then the lines were cut into three or four equal sections, depending on each alternative's specifications (see Figure H-2). The points at which the lines were segmented were used for snapping the GIS cutting tools. Since the blocks identified by the EFH Committee match closely to NMFS reporting area boundaries but extend past the 1,000-meter (m) contour, many assumptions would have been necessary if the blocks were to be cut into areas based on square units of area. Instead, blocks were cut into areas of equal width.

H.7 Fisheries Database

The fisheries Catch-In-Areas with Redistribution (CIA-R) database was developed using 2001 fisheries catch data from the Catch-By-Vessel (CBV) [D. Ackley] and 2001 Blend data [G. Tromble]. These two datasets were combined using an iteration process [J. Noel]. Both datasets have useful information: the CBV has the spatial resolution of ADF&G groundfish statistical areas and has catch by vessel information, gear, probable target, and several other useful attributes. The Blend is often used as a

baseline for modeling at the Alaska Fisheries Science Center and has useful data for retained and discarded catch.

Table H-3 summarizes the sequence of matching operations that was performed to match the Blend data to the CBV data. The process begins with a high-resolution set of grouping fields, including processor ID. With that set, we were able to match 89 percent (by weight) of the Blend data to records in the CBV dataset and find multipliers to distribute the reporting area catch of the Blend among 6-digit statistical areas. The remaining Blend data were handled by repeating the process several times with progressively lower-resolution groupings. Each iteration decreased the resolution by either removing a field from the previous grouping list or replacing it with an equivalent, coarser-resolution field. The resulting final database table includes a field called "iteration," which indicates which iteration created the record. Because Iteration 9 contributed only 311 metric tons (mt) of catch and its spatial resolution was null, Iteration 9 was not carried through in this analysis.

Table H-3. Blend to Catch-By-Vessel Matching Iteration Process

Iteration	Grouping Fields	Weight (mt)	% of Total
1	Processor ID, processor type, week, reporting area, gear, species	1,794,938	88.73%
2	Processor type, week, reporting area, gear, species	173,508	8.58%
3	Processor type, week, reporting area, gear, SpecGrp	26,746	1.32%
4	Processor type, quarter, reporting area, gear, SpecGrp	12,337	0.61%
5	Processor type, quarter, subregion, gear, SpecGrp	5345	0.26%
6	Quarter, subregion, gear, SpecGrp	4799	0.24%
7	Subregion, gear, SpecGrp	709	0.035%
8	Gear, SpecGrp	4210	0.208%
9	SpecGrp	311	0.015%

Total weight of blend: 2,022,903 mt.

H.8 Proportional Allocation

Since most of the StQ and EFH fishing impact minimization alternatives' boundaries do not correspond directly to ADF&G groundfish statistical areas (the first 3 nautical miles [nm] from shore are the inside waters state statistical areas; beyond this, the state statistical areas are generally bounded by 1 degree of longitude by 30 minutes of latitude, approximately 35 nm wide by 30 nm long), proportional allocation was used to assign catch from the database to closed areas. However, since EFH Alternative 5B was designed with observer data by latitude and longitude, observer data were used to assign catch to EFH Alternative 5B in the AI subarea. (See Section H.13, Catch and CPUE of Target Fisheries Inside and Outside of EFH Mitigation Alternatives.)

Observer data alone were not generally used for this fisheries analysis since they lack spatial resolution for catcher vessels delivering to shoreside processors. However, observer data are accurate for representing trawl catch in the larger fisheries in the AI.

To spatially refine proportional allocation of catch for those statistical areas that traversed the 1,000-m contour, all catch were assumed to be inside of 1,000 m. The alternatives were cut at the 1,000-m boundary for this analysis as well; otherwise, the numerator (square meters [sq. m] of the alternative) may have exceeded the denominator (sq. m of the state statistical area cut at the 1,000-m boundary) or otherwise inflated the significance of a given restriction.

In a step called Prop-Areas, the CIA-R database created a unique record for each ADF&G groundfish statistical area, gear type, probable target, start date, end date, and returns proportional area by dividing each alternative's Shape-Area field by the State-Stat-Area_1000meters Shape-Area field.

The next step is the actual Catch-In-Areas algorithm. The database compares Prop_Areas to the catch data. Where it finds an exact match from the Prop-Areas step, the catch for that given record is multiplied by the proportional amount from that record and then inserted into the new table.

H.9 Finding the Delta

The next operation performs two functions: 1) it checks whether the database return numbers are negative or otherwise unreasonable, and 2) it provides the actual delta or difference between the catch under status quo and under the selected EFH fishing impact minimization alternative. This is done by subtracting Alternative 1 (status quo) from each of the EFH alternatives. This determines the net change in catch due only to the EFH fishing impact minimization measures (delta or catch-at-risk). This function is possible because the EFH alternatives were integrated into the status quo. The delta values from each alternative were used for assigning the actual value to the EFH alternatives. Some data noise is created in this process, but it amounts generally to less than 10 kilograms per statistical area.

H.10 Valuing the Catch

To assign a value to the catch-at-risk, catcher vessels delivering to shoreside processors had separate pricing from the catcher-processors and motherships. This is due to the large difference between the ex-vessel price a catcher vessel receives by selling unprocessed fish and that of the catcher-processor or mothership selling processed fish to the first wholesaler.

Pricing was provided for catcher vessels by Council staff (Elaine Dinneford) and for catcher-processors and motherships by NMFS economists using first wholesale values. The pricing was matched to the database with processor ID, gear, species, and subregion. Where there was no match for processor ID, processor ID was dropped, and a weighted average was leveraged on remaining processor IDs by gear, species, and subregion. Each alternative's delta was multiplied by this associated value per metric ton for the final value. All summaries of data beyond this point in the analysis are averages of the value per metric ton.

Summary tables were created that filtered out discarded catch and more obscure species and data noise such as shrimp, salmon, halibut and many of the obscure non-FMP species. The catch data did not fully account for many of these species, and it would have been inaccurate to include them. Table H-4 is an example of these summary tables. The actual alternatives are not shown in this summary table.

H.11 Catch and Redistribution Maps

The analysis for these maps restricts the catch by area, probable target, gear type, and, if seasonal, the start and stop dates of the closure. Proportional allocation of catch is based on state statistical areas relative to the size of the closure. The state statistical areas have been cut at 1,000 meters in order to add resolution to the catch data. [Limiting the area size of the state statistical areas that straddle the 1,000-meter bathymetric line to only that area within 1,000 meters, reduces the size of the denominator in the proportional allocation method. Proportional allocation simply divides the size of the restricted area (numerator) by the size of the state statistical area (denominator). The resulting ratio is then multiplied by the catch in that state statistical area.] The assumption is that the catch is evenly distributed in the state statistical area within the 1,000-meter depth range.

Table H-4. Example of Data Output

FMP	DESG	GEAR	Total Wt	CV Value	Average CV Value\Ton	CP Value	Average CP Value\Ton
BSAI	M	NPT	3,811			$4,767,104	$1,177
BSAI	M	POT	1,364			$1,712,334	$1,075
BSAI	M	PTR	141,287			$104,297,864	$1,197
BSAI	P	HAL	116,083			$141,890,951	$1,103
BSAI	P	NPT	204,026			$179,260,011	$988
BSAI	P	POT	3,091			$3,891,220	$1,138
BSAI	P	PTR	608,507			$448,804,818	$990
BSAI	S	HAL	1,827	$4,060,780	$1,382		
BSAI	S	JIG	74	$43,586	$622		
BSAI	S	NPT	16,137	$8,124,283	$306		
BSAI	S	POT	12,763	$7,576,714	$649		
BSAI	S	PTR	606,871	$102,907,576	$108		
GOA	M	NPT	0			$7	$1,176
GOA	M	PTR	67			$78,748	$1,176
GOA	P	HAL	5,563			$11,851,690	$3,240
GOA	P	NPT	19,754			$20,282,279	$1,725
GOA	P	POT	1,629			$2,098,888	$1,184
GOA	P	PTR	573			$300,481	$1,172
GOA	S	HAL	17,867	$52,067,217	$1,660		
GOA	S	JIG	345	$270,980	$926		
GOA	S	NPT	42,145	$16,094,291	$393		
GOA	S	POT	5,468	$3,590,583	$696		
GOA	S	PTR	67,880	$9,698,304	$205		
Retained	**Total**		**1,877,133**	**$204,434,313**		**$919,236,395**	

Notes: M = Mothership; P = Catcher Processor; S = Shoreside; CV = catcher vessel; CP = catcher-processor; NPT = nonpelagic trawl; POT = pot; PTR = pelagic trawl; JIG = jig; HAL = hook and line

The green state statistical areas (X_delta) represent two concepts:

1. All the state statistical areas where a species was caught in 2001 - targeted or incidental.

2. All the catch that occurred in 2001 that would be prohibited under the EFH alternative. See the legend for alternative numbers and the species groups represented. This restricted catch accounts only for that additional catch that would not have been restricted under the current management scenario. The darker the green, the more net catch that is being restricted by the EFH Alternative.

The red bars (Amt_In) represent the amount of catch in the 2001 catch data that would be prohibited by the current management and the EFH Alternative.

The blue bars (Amt_Out) represent the amount of actual 2001 catch that can still be caught under the current management and the EFH Alternative.

The purple bars (Amt_After) represent the amount of catch in 2001 that has been redistributed (by species and relative to how much of that species was taken in each statistical area) to other ADF&G statistical areas within the same NMFS reporting area. This redistributed catch includes the original species catch weight and the catch that must be redistributed by the EFH Alternative's closure.

Redistributed catch (purple bar) illustrates a probable location where catch may be displaced by the alternative. It is possible that catch will be redistributed into areas partially closed by an alternative since there still may be open or outside catch of that species in that statistical area.
Redistributed catch is equal to the weight of that species that can still be caught in the given state statistical area multiplied by the ratio of total weight of that species in the related NMFS reporting area by the total weight of that species that can still be caught in that NMFS reporting area. In simpler terms, it redistributes the species weight proportional to how much weight of that species remains open in each state statistical area within the same NMFS reporting area.

$$Wr = Wo\left(\frac{\sum Wt}{\sum Wo}\right)$$

Where:

Wr = Redistributed catch by state statistical area
Wt = Total weight by species by state statistical areas
Wo = Catch that is outside restricted\closed state statistical areas
Σ = The sum of the species over the entire NMFS reporting areas

The redistribution analysis was intended for use in qualitative assessments, representing areas to which the catch may be redistributed if an alternative's restrictions were put into place. This does not account for localized depletion or the rate of change in the catch of one species complex relative to another after the distribution.

The number next to the three bars in the legend represents the metric tons of catch that would be displaced by the EFH alternative and the current management (status quo) because the status quo measures differ from the 2001 catch data. It is not intended to be consistent with the X_delta (gradients of green of the state statistical areas), which represents only the net change in the catch due to the EFH Alternative.

Dark blue outlines represent the EFH Alternative in question. The yellow-orange outlines represent most of the current spatial management closures. Bycatch limitation zones are not shown or analyzed in this analysis.

H.12 Spatial Analysis

Each EFH fishing impact minimization alternative has an associated closure area as a component. To effectively compare each alternative with another, a series of calculations was performed to find the affected area. Each alternative had area calculations performed for the full extent of the closure, the extent of the closure within 1,000 m (defined here as the fishable area), and the extent of the closure beyond the 1,000-m depth. Additionally, the percent affected was calculated for each alternative by taking the areas of the alternative as a ratio to the extent of the management area. Results were provided in both square kilometers and square nautical miles.

The area calculations are completed by first dissolving and then integrating the alternative's polygons. This procedure dissolves overlaps and polygonic regions that may otherwise double count area. A double-precision field is created and then updated with a function called pArea. This function uses the Gauss calculation of polygon area, the industry standard.

The analysis did not take into account partial closures such as the Steller sea lion protection measures, which generally limit fishing by gear type only to the Steller prey species: pollock, Atka mackerel, and Pacific cod. It should be noted, however, that the only areas that currently fully protect habitat from all bottom contact are the thirty-seven 3-nm No Transit zones and the Sitka Pinnacles. Other status quo measures protect habitat through trawl or nonpelagic trawl restrictions, which do not apply to all bottom-contact gear types. Where many of the EFH alternatives restrict all bottom trawling, an insignificant amount of these EFH closures overlap current closures.

H.13 Catch (OTC) and CPUE of Target Fisheries Inside and Outside of EFH Fishing Impact Minimization Alternatives

Observer data was gathered for the years 1998 through 2002 from the North Pacific groundfish observer program database NORPAC. Each haul or set for those years was assigned a target fishery, similar to the algorithm used by NMFS Alaska Region. Each haul or set included an overall observed catch recorded in metric tons, a latitude and longitude of gear retrieval, year, duration, and a calculation of effort. The effort calculation was to approximate the area swept by that gear type. The calculation was based on the vessel's duration in hours multiplied by an effort adjustment for each gear type and vessel size, yielding a value in square kilometers (sq. km) (see Appendix B).

The observer data was brought into a GIS environment using ArcGIS 8.3. Additional polygon coverages representing closure areas of the fishing impact minimization alternatives were in the GIS project. Each target fishery that applied to that EFH fishing impact minimization measure was summarized as follows: The observer data was used to summarize the total amount in mt (Official Total Catch, OTC) harvested by that summary for all hauls/sets for the 5-year period. The data were also summarized for the calculated effort. The next step joined the observer data to the EFH fishing impact minimization measure, and the amount of catch and effort within each closure area was tabulated. Calculations were made for both catch and effort inside and outside of each EFH fishing impact minimization measure (Table H-5).

Table H-5. EFH Fishing Impact Minimization Alternative 5

Fishery	Atka Mackerel Trawl	Pacific Cod Trawl	Pollock Trawl	Rockfish Trawl	Sablefish & Greenland Turbot trawl
Amount (OTC)	312,513	101,562	6,134	53,669	9,226
Amount (OTC) inside closures	4,908	2,294	0	6,185	0
Amount (OTC) outside	307,604	99,268	6,134	47,483	9,226
% of fishery affected by closure	1.57%	2.26%	0.00%	11.53%	0
Effort overall	5,605	6,142	254	1,035	710
Effort sq. km within closures	82.64	121.24	0.00	149.90	0.00
CPUE =(OTC)/(Effort)	55.75	16.54	24.06	51.81	12.99
Amount (CPUE) inside closures	59.40	18.92	0.00	41.27	0.00
Amount (CPUE) outside (Catch T-Catch1_/(Effort T-Effort 1)	55.70	16.49	24.06	53.59	12.99

Note: Closes nonpelagic trawl fishing in five areas within the AI. Weights are recorded in mt, based on extrapolated observed total catch for the 1998-2002 period. Catch per unit effort is based on catch to area swept.

H.14 Geographic Distribution of Fisheries

This portion of the analysis used data provided by the NMFS domestic groundfish observer program database (NORPAC), years 1990 to 2002. Data were sorted by gear types: nonpelagic trawl, pelagic trawl, hook and line (longline), and pot. Each haul or set had a target assigned based on haul and weekly catch, similar to the algorithm used by NMFS Alaska Region (E. Dinneford, Council staff). Locations of each haul or set of each fishery (denoted as retrieval position of hauls) were plotted spatially using GIS technology to aid in analysis of spatial patterns. The locations of all fishing activities were plotted as point data. Fishing effort locations were summarized on a geographical scale of 25 sq. km. This summary provided a clearer depiction of fishing density since many hauls/sets are close together and would overlap when looked at over multiple years. An Alaska Albers projection was used to encompass the data on both sides of the 180º A polygon coverage, composed of 25-sq. km grid squares overlaid onto the trawl location data. An intersect function allowed the point data 25-sq. km areas to be summarized by effort and trawl time within grid squares. The data were categorized by an ArcView function of natural breaks to display both effort and trawl time by three groupings. This method identifies breakpoints between classes using a statistical formula (Jenk's optimization) that minimizes the sum of the variance within each of the classes. The data were displayed in three categories. This step was repeated for each fishery within the GOA, AI, and EBS.

H.15 Habitat Species Distribution

For EFH Definition Alternatives 2, 3, and 4, EFH would be defined as a subset of each species' range, generally between 75 and 95 percent of the spatial distribution of the entire species' range, or for each particular life history stage, as the alternatives dictate. EFH Definition Alternative 2 is referred to as Revised General Distribution – 95 percent. Alternative 3 is referred to as Presumed Known Concentration – 75 percent.

To find this subset of each species's range, RACE (1961 to 2001) and NORPAC (1987-2002) databases were queried. Population estimates were based on extrapolated weight/duration for trawls and thousands of hooks for longline. For each record, CPUE was divided by total CPUE for a relative abundance estimate (ABUN). The ABUN column was sorted by highest relative abundance to lowest relative abundance. A cumulative column (CUMULATED) was created, as shown in Table H-6.

Table H-6. Example of Cumulative Calculation

ABUN	CUMULATED
1	1
2	1+2=3
3	3+3=6

Sample data:

ABUN	CUMULATED
0.10114895525	0.10114895525
0.05175383102	0.15290278627
0.03997601112	0.19287879739
0.03923292519	0.23211172258
0.03052224149	0.26263396407

The CUMULATED data serve as a proxy for population. These data were then displayed with CUMULATED <= 0.75 and <= 0.95, respectively for Presumed Known Concentration – 75 percent, and Revised General Distribution – 95 percent.

RACE and NORPAC CUMULATED values were displayed visually on screen in ArcGIS 8.3. Analysts used best professional judgement, knowledge of the species, and bathymetry to aid in drawing polygons around these point distributions at the 95 and 75 percent distribution levels.

H.16 Creation of Alternative 5B

The Aleutian Seafloor Habitat Protection Alternative, Alternative 5B, forwarded by Oceana at the December 2002 Council meeting, had four components: 1) no expansion of bottom trawl fisheries to new areas, 2) areas that had a high rate of bycatch of corals and sponges and a low rate of catch should be closed to bottom trawling, with an accompanying decrease in TAC, 3) area-specific bycatch limits should be imposed, and 4) a comprehensive research and monitoring plan should be implemented. Also required under this alternative for the AI was 100 percent observer coverage and 100 percent VMS coverage of vessels fishing for groundfish in the AI and use of the CADRES program when possible. The Council added this alternative as a sub-option under EFH fishing impact minimization Alternative 5.

There are two parts to this analysis, open and closed areas. For the open area approach, bottom trawling is limited to historic areas, and closed areas are those that had a high rate of bycatch of coral and sponges and a low rate of targeted catch. The open area analysis was based on effort data (defined by number of hauls), where the number of hauls was broken into three categories based partially on the distribution of the data. The initial analysis of the AI used data from 1990 through 2001, so the top effort category also represented areas fished more than one time per year over 11 years. Subsequent analyses of the EBS and GOA were based on data from 1997 to 2001 and 1990 to 2000, respectively. All grids in the top category of effort were included in open areas.

This method of analysis was used for the attached maps of the EBS, GOA, and AI, and included the following steps to accomplish the first two of the four Alternative 5B components noted above:

NO EXPANSION OF BOTTOM TRAWL FISHERIES TO NEW AREAS

1. Display effort data, categorized into 1-3, 4-10, >10 trawls.
2. Overlay latitute/longitude grid
3. Attempt to make open areas that include all of the highest category of effort (>10)
4. Attempt to make areas as linear as possible (least number of sides).

CLOSE AREAS WITH HIGH BYCATCH RATES AND LOW CATCH RATES

1. Query the point data for the correct gear type, area, and range of years
2. Sum the point data to grid
3. Create CPUE columns and calculate CPUE for both bycatch and total catch grid files (catch/duration)
4. Join bycatch and catch grids
5. Display quantities, graduated colors with ration of bycatch CPUE/catch CPUE in natural breaks, in categories.
6. Select all blocks from highest two categories, any two contiguous blocks from third category
7. Overlay 5k grid layer, set as selectable. Display catch data (OTONS) under chosen blocks to aid in selection of at least four square blocks. Select configuration that impacts least number of OTONS. These are the areas closed for bycatch reasons.

H.17 Alaska Fisheries Information Network's (AKFIN) Methods for Finding Commercial Harvest of Crab, Halibut, Herring, and Scallops by State Statistical Area

Vessel and Processor Diversification

Groundfish catch by vessels fishing in each of the EFH alternative areas was filtered from the fisheries Catch-In-Areas with Redistribution (CIA-R) database by NOAA Fisheries and provided to AKFIN. AKFIN used this dataset to create a database for evaluation of vessel and processor diversification and community impacts of the EFH alternatives. Statewide catch and value were estimated for major groundfish species (Pacific cod, pollock, other groundfish, and total groundfish), halibut, crab, scallops, salmon, herring, and other non-groundfish species (clams, octopi, squid, shrimp, urchin, and other freshwater finfish) by impacted vessel for the years 1998 through 2001.

Similarly to the vessel diversification data, commercial harvest was aggregated by processor for those receiving deliveries from impacted vessels or impacted catcher-processors. Processor characteristics were included from the federal permit and State Intent to Operate databases.

Catch was filtered to exclude noncommercial harvests, discards, ancillary products, and bycatch. Characteristics of each vessel and vessel owner area of residency were also added to the database. Source of the catch data and estimated value depended on the type of vessel. The data source for catcher vessels delivering to shoreside processors was ADF&G fish tickets and CFEC ex-vessel prices. The data source for catcher-processors and motherships was NOAA Fisheries Blend and NorPAC harvest. Wholesale prices were derived by species grouping, Council area, and gear for catcher-processors.

Catch and value of major groundfish species was included in AKFIN's database to demonstrate similarity of the AKFIN and CIA-R estimates for 2001 and allow extension of analysis of diversification and community impacts to the years 1998, 1999, and 2000.

Fishing Intensity

For each groundfish statistical area in the Council GIS, AKFIN summarized ADF&G fish ticket commercial harvest of crab, scallops, herring, and halibut for 1998 through 2001. The summary catch included deadloss but excluded discards, bycatch, and ancillary products. For groundfish areas where the data were confidential, an indicator was provided for use by the GIS system. Two to five percent of the harvest of crab, herring, and halibut was excluded due to confidentiality. Twelve percent of the scallop harvest was confidential. Halibut data (based on IPHC areas) were extrapolated to ADF&G groundfish statistical areas. Herring statistical areas were also translated to groundfish statistical areas with manual translation where a herring area contained more than one groundfish area.

Methodology for the diversification and fishing intensity datasets detailing extrapolation of halibut harvest by statistical area and federal groundfish harvest to ADF&G groundfish statistical area can be found elsewhere in the NOAA Fisheries administrative record.

H.18 Methodology for Minimization Alternative 5B TAC Reductions and Bycatch Limits

Alternative 5B for minimizing the adverse effects of fishing on EFH would allow bottom trawling in the AI only in designated open areas, defined as those areas with higher effort distribution (with the exception of specific areas with high coral/bryozoan and sponge bycatch rates and low CPUE). The TAC reduction and coral/byrozoan and sponge bycatch limit components of Alternative 5B were developed through data analysis described in this section.

A draft analysis of TAC reductions and bycatch limits pertinent to Alternative 5B was prepared for the June 2003 Council meeting, and has since been revised. The revisions were: (1) including the 2002 blend data for establishing bycatch limits, (2) including the number and percent of sample hauls with associated bycatch of other, non-groundfish species, (3) including in the counts of observed vessels a small number of vessels that had not observed bycatch in any haul in an entire year, and (4) adjusting the denominators for the coral and sponge bycatch rates to reflect only the extrapolated weights of the weekly target species in a given area (in the previous draft, these denominators included the total weekly target extrapolated weights regardless of area). The following discussion of methodology incorporates these revisions, and the results are reflected in the bycatch numbers contained in the Alternative 5B description.

TAC Reductions

Council staff examined observer data from 1998-2002 to estimate the percent of catch taken from areas that would be closed to bottom trawling under Alternative 5B. Based on the amount of total catch (all species) across all five years, the percent of catch outside the 'open' areas in the trawl fisheries was as follows: Atka mackerel, 5.55 percent; Pacific cod, 10.23 percent; and rockfish, 11.99 percent (Table H-7). No other fisheries would be affected, as the amounts are insignificant for other species. Note that these numbers are substantially different than the 3.7 percent which had been reported in the draft Chapter 2, because the previous figure was based on 1990-2001 data (which had included 1990-1998 AI pollock fisheries in the official tons of catch).

In the case of Atka mackerel, the TAC reduction is straightforward, because the TAC is set for the AI management areas, and 98 percent is allocated to the trawl fishery (2 percent to jig gear). Thus the TAC reduction for trawl gear within each regulatory area (541, 542, 543) would be a 6 percent reduction in AI Atka mackerel trawl TAC (rounded number).

Table H-7. Total Observed Catch (mt) for the Aleutian Islands Region, Inside and Outside the 'Open' Areas Designated for Mitigation Alternative 5B, Based on Observed Vessels, 1998-2002

Fishery	Atka Mackeral Trawl	P cod trawl	Pollock trawl	Rockfish trawl	Sablefish & Greenland Turbot trawl
Amount (OTC)	312,513.39	101,562.04	6,134.32	53,669.46	9,226.70
Amount (OTC)inside closures	17,331.85	10,393.50	106.10	6,433.45	0.06
Amount (OTC) outside	295,181.54	91,168.54	6,028.22	47,236.01	9,226.64
% of fishery effected by closure	**5.55%**	**10.23%**	**1.73%**	**11.99%**	0.00%
Effort overall	5,605.38	6,142.02	254.96	1,035.88	710.16
Effort km2 within closures	382.19	584.09	1.86	128.23	1.19
CPUE =(OTC)/(Effort)	55.75	16.54	24.06	51.81	12.99
Amount (CPUE) inside closures	45.35	17.79	57.04	50.17	0.05
Amount (CPUE) outside	56.51	16.40	23.82	52.04	13.01
(Catch T-Catch1_/(Effort T-Effort 1)					

Note: Effort is the area swept, which is based on haul duration and gear of each target fishery (C. Rose).

For Pacific cod, a TAC reduction is more complex. The Pacific cod TAC is specified BSAI-wide, so any TAC reduction would also reduce catches in the Bering Sea as well as the AI area. Further, the BSAI Pacific cod TAC is allocated to trawl (47 percent), jig (2 percent), and fixed gear, 51 percent (fixed gear is then further suballocated to many sectors). The TAC reduction be applied to the 47 percent BSAI trawl Pacific cod TAC, resulting in an 10 percent reduction in the BSAI Pacific cod trawl TAC (rounded number). The draft EIS assumes that the catch would be reduced in both the AI and EBS; these

reductions would likely occur in similar proportion to recent catches (approximately 25 percent AI; 75 percent EBS).

For rockfish, the TAC reductions are fairly straightforward. In the BSAI area, rockfish TACs are set separately for the EBS and AI region. AI rockfish are managed in the following complexes: Pacific ocean perch, northern rockfish, shortraker/rougheye, and other rockfish. Nearly all the catch is taken by trawl gear, with the exception of shortraker/rougheye, whose AI TAC is allocated to trawl (80 percent) and fixed gear (20 percent). Thus the TAC reductions would be as follows: 12 percent for POP, northerns, and other rockfish, and a 12 percent reduction in the AI shortraker/rougheye TAC apportioned to trawl gear (rounded numbers).

Application of these percentages to the 2003 TACs results in the reductions shown in Table H-8. The preliminary draft EFH EIS analysis and RIR were prepared using these TAC reductions.

Table H-8. Reduction in 2003 TACs Based on Percent TAC Reductions Associated with Mitigation Alternative 5B

Species/Fishery Component	TAC Reduction %	2003 TAC (Trawl Only) (mt)	2003 TAC Reduction (mt)
AI Atka Mackerel	6.0%	45649	2739
EBS Pacific cod *	10.0%	67658	6766
AI Pacific cod *	10.0%	22553	2255
Total Pacific Cod		90210	9021
AI, POP, NRF, ORF	12.0%	17716	2126
AI, SRF/RRF	12.0%	538	65
Total Rockfish		18254	2190

Coral/Bryozoan and Sponge Bycatch Limits

Council staff examined observer data from 1998-2002 for trawl fisheries in the Aleutian Islands to generate estimates of bycatch rates for two groups (coral/bryozoans and sponges) by target fishery and regulatory area (541, 542, 543). The corals and bryozoans are combined because this is how they are treated in the observer data. Estimates of coral/bryozoan and sponge bycatch in the Atka mackerel, Pacific cod, and rockfish trawl fisheries in the Aleutian Islands (federal zones 541, 542, and 543) were developed by creating an annual bycatch rate from observer data[1] and then applying this rate to parallel NMFS blend data. The rates included data from Community Development Quota (CDQ) harvests as well as discarded harvests. Likewise, the rates were applied to blend data containing both CDQ and discarded harvests.

[1] NPFMC Observer EFH Report file. This file was developed from observer data by Council staff with the assistance of Dr. Craig Rose. Observer data were assigned a weekly target species specifically intended to mirror the weekly targeting algorithm used by the NMFS Sustainable Fisheries Division.

Coral/bryozoan and sponge bycatch rates were computed from sampled haul information taken from the 1998-2002 NPFMC Observer report file in the following manner:

1. Vessel specific annual coral/bryozoan and sponge bycatch rates were computed for each federal zone by dividing the sum of the coral/bryozoan (or sponge) extrapolated weights from the observer data (kg) by the sum of the round metric tons in that zone of the specie identified as the weekly target for a given vessel and year. Vessel specific rates were created for two reasons: First, vessel specific records allow an enumeration of unique vessels in subsequent summarizations, which in turn are required for confidentiality assessments. Second, the researchers would be able to review the incidence and relative amounts of coral/bryozoan (or sponge) bycatch among the vessels in a given fishery. Note that these data are not discloseable to the public.

2. A fleetwide bycatch rate was computed from the vessel specific data by, again, summing the total sampled coral/bryozoan weights (kg) and dividing by the total target species' round metric tons within each zone. The rate is expressed in kilograms of coral/bryozoans (or sponge) per round metric ton of the target species.

Estimates of the coral/bryozoan and sponge bycatch were computed by multiplying the above rates with the trawl-caught Atka mackerel, Pacific cod, or rockfish total catch where these species were identified as targets in the NMFS 1998-2002 blend data for federal zones 541, 542, and 543.

The fleetwide incidental catch rates for each bycatch group, target fishery, area, and year (Tables H-9 and H-10) were applied to the corresponding best blend catch estimate of the target species to generate total bycatch estimates (mt). The catches across all management areas by target fishery and bycatch group are shown in Tables H-11 and H-12.

Bycatch limits were set at or near the upper end of the observed bycatch levels. This procedure has been used by the Council in previous actions to establish initial bycatch limits for salmon, herring, and crab. The intent of these limits is to control bycatch within historically observed levels. Once the fishing industry adapts to these limits, they can been reduced over time (as has been done with crab and chinook salmon limits). The preliminary draft EFH EIS analysis and RIR assume that under these bycatch limits, closures of the fleet would be relatively uncommon.

The expanded catch amounts shown in Tables H-13 and H-14 were used to set the bycatch limits based on the maximum annual amount estimated for the years examined. In the cases where data were limited by confidentiality (e.g., the Pacific cod fishery in 543), the amount for the adjacent area was used. In some cases, the bycatch limits were reduced if there appeared to be outliers, defined as an annual bycatch estimate over 2 mt that was more than twice the amount estimated for any of the other years examined [note that outliers occurred in a few instances: 1998 sponge catch in the 541 Pacific cod fishery, 1998 coral/bryozoan catch in the 541 Pacific cod fishery, 2002 sponge catch in the 543 rockfish fishery, and 1999 catch of coral/bryozoans in the 542 rockfish fishery]. In all cases, the limits were rounded to the nearest mt. The resulting bycatch limits are show in Table H-15.

Table H-9. Observed Aleutian Islands Trawl Bryozoan and Coral Bycatch by Target Species and Federal Zone, 1998-2002 (by Regulatory Area)

Weekly Target Species	Zone	Year	Observed Vessels	Vessels W/ Bryozoan bycatch	Un-sampled Hauls	Total Sampled Hauls	Hauls with Bycatch	%	Hauls W/ Bryozoan Bycatch	%	Bryozoan Bycatch Rate (kg/ton)	Observed Bryozoan Bycatch (kg)	Target Species (mtons)
Atka Mackeral	541	1998	7	0	46	210	134	63.8	0	0.0	.	.	8,872
		1999	10	6	74	287	205	71.4	39	13.6	0.076	893	11,821
		2000	9	8	67	232	168	72.4	39	16.8	0.096	1,105	11,490
		2001	9	7	44	116	83	71.6	29	25.0	0.238	1,301	5,468
		2002	9	3	5	70	41	58.6	3	4.3	0.005	17	3,604
		All	12	10	236	915	631	69.0	110	12.0	0.080	3,316	41,255
	542	1998	8	3	159	279	144	51.6	19	6.8	0.148	2,110	14,218
		1999	10	5	172	369	202	54.7	16	4.3	0.012	201	17,264
		2000	8	5	186	468	309	66.0	41	8.8	0.071	1,269	17,804
		2001	9	9	129	476	319	67.0	64	13.4	0.082	2,240	27,291
		2002	10	9	25	407	272	66.8	37	9.1	0.049	1,033	21,083
		All	13	12	671	1999	1246	62.3	177	8.9	0.070	6,853	97,660
	543	1998	9	6	229	557	282	50.6	25	4.5	0.151	2,764	18,264
		1999	9	7	138	417	326	78.2	45	10.8	0.149	1,883	12,617
		2000	6	3	30	206	113	54.9	47	22.8	0.432	4,116	9,535
		2001	8	8	165	439	272	62.0	65	14.8	0.388	6,233	16,053
		2002	8	7	32	435	304	69.9	86	19.8	0.369	6,126	16,608
		All	11	11	594	2054	1297	63.1	268	13.0	0.289	21,124	73,078
Pacific Cod	541	1998	16	9	267	382	221	57.9	51	13.4	0.510	3,796	7,438
		1999	15	9	128	431	344	79.8	69	16.0	0.120	1,322	11,041
		2000	29	13	162	587	322	54.9	31	5.3	0.029	256	8,796
		2001	18	7	109	416	284	68.3	80	19.2	0.106	735	6,959
		2002	25	12	243	656	305	46.5	28	4.3	0.103	1,216	11,788
		All	57	36	909	2472	1476	59.7	259	10.5	0.159	7,325	46,022
	542	1998	9	4	68	92	61	66.3	9	9.8	0.369	864	2,342
		1999	8	3	21	54	46	85.2	6	11.1	0.054	46	846
		2000	14	5	61	154	114	74.0	19	12.3	0.099	198	2,004
		2001	13	5	72	147	116	78.9	24	16.3	0.341	784	2,296
		2002	13	5	46	204	169	82.8	44	21.6	0.503	2,207	4,390
		All	29	15	268	651	506	77.7	102	15.7	0.345	4,098	11,878
	543	1998	2	0	1	3	2	66.7	0	0.0	.	.	.
		2000	2	2	23	41	33	80.5	26	63.4	.	.	.
		2001	2	1	5	5	4	80.0	3	60.0	.	.	.
		2002	4	3	17	44	35	79.5	29	65.9	5.016	4,517	900
		All	6	3	46	93	74	79.6	58	62.4	6.329	13,176	2,082
Rockfish	541	1998	6	0	11	22	7	31.8	0	0.0	.	.	1,146
		1999	5	1	19	39	18	46.2	2	5.1	.	.	2,172
		2000	5	4	13	34	27	79.4	5	14.7	0.101	157	1,556
		2001	4	2	54	48	34	70.8	3	6.3	.	.	1,472
		2002	5	1	24	52	20	38.5	1	1.9	.	.	1,755
		All	10	4	121	195	106	54.4	11	5.6	0.097	783	8,101
	542	1998	5	1	8	38	29	76.3	2	5.3	.	.	1,588
		1999	6	4	17	47	45	95.7	11	23.4	0.743	1,668	2,245
		2000	5	2	23	40	32	80.0	3	7.5	.	.	1,646
		2001	5	3	43	40	17	42.5	3	7.5	0.250	264	1,057
		2002	5	2	23	47	25	53.2	13	27.7	.	.	1,776
		All	9	7	114	212	148	69.8	32	15.1	0.310	2,576	8,312
	543	1998	5	2	17	56	33	58.9	5	8.9	.	.	3,273
		1999	4	2	19	90	68	75.6	5	5.6	.	.	5,546
		2000	6	4	25	72	55	76.4	7	9.7	1.697	6,018	3,547
		2001	4	1	12	30	20	66.7	5	16.7	.	.	2,135
		2002	5	1	25	67	52	77.6	8	11.9	.	.	3,235
		All	8	5	98	315	228	72.4	30	9.5	2.136	37,875	17,736

From NPFMC EFH Observer Report File, April 2003
A '.' denotes confidential data
Report2a.sas

Table H-10. Observed Aleutian Islands Trawl Sponge Bycatch by Target Species and Federal Zone, 1998-2002 (All Regulatory Areas)

Weekly Target Species	Zone	Year	Observed Vessels	Vessels W/ Sponge bycatch	Un-sampled Hauls	Total Sampled Hauls	Hauls with Bycatch	%	Hauls W/ Sponge Bycatch	%	Sponge Bycatch Rate (kg/ton)	Observed Sponge Bycatch (kg)	Target Species (mtons)
Atka Mackeral	541	1998	7	6	46	210	134	63.8	57	27.1	0.822	7,289	8,872
		1999	10	8	74	287	205	71.4	90	31.4	0.342	4,042	11,821
		2000	9	8	67	232	168	72.4	89	38.4	0.685	7,872	11,490
		2001	9	9	44	116	83	71.6	33	28.4	0.250	1,369	5,468
		2002	9	4	5	70	41	58.6	10	14.3	0.078	281	3,604
		All	12	12	236	915	631	69.0	279	30.5	0.505	20,852	41,255
	542	1998	8	5	159	279	144	51.6	73	26.2	0.681	9,683	14,218
		1999	10	7	172	369	202	54.7	125	33.9	0.875	15,102	17,264
		2000	8	7	186	468	309	66.0	145	31.0	0.502	8,944	17,804
		2001	9	9	129	476	319	67.0	149	31.3	0.630	17,186	27,291
		2002	10	9	25	407	272	66.8	117	28.7	0.251	5,291	21,083
		All	13	12	671	1999	1246	62.3	609	30.5	0.576	56,206	97,660
	543	1998	9	6	229	557	282	50.6	108	19.4	1.194	21,798	18,264
		1999	9	9	138	417	326	78.2	239	57.3	4.087	51,571	12,617
		2000	6	4	30	206	113	54.9	67	32.5	0.758	7,228	9,535
		2001	8	8	165	439	272	62.0	77	17.5	0.438	7,026	16,053
		2002	8	8	32	435	304	69.9	157	36.1	3.511	58,303	16,608
		All	11	10	594	2054	1297	63.1	648	31.5	1.997	145,926	73,078
Pacific Cod	541	1998	16	13	267	382	221	57.9	108	28.3	3.777	28,091	7,438
		1999	15	10	128	431	344	79.8	161	37.4	0.867	9,573	11,041
		2000	29	17	162	587	322	54.9	75	12.8	0.262	2,303	8,796
		2001	18	13	109	416	284	68.3	126	30.3	0.317	2,207	6,959
		2002	25	15	243	656	305	46.5	74	11.3	0.288	3,396	11,788
		All	57	43	909	2472	1476	59.7	544	22.0	0.990	45,570	46,022
	542	1998	9	6	68	92	61	66.3	35	38.0	1.886	4,418	2,342
		1999	8	6	21	54	46	85.2	41	75.9	3.859	3,264	846
		2000	14	13	61	154	114	74.0	61	39.6	4.168	8,353	2,004
		2001	13	7	72	147	116	78.9	58	39.5	2.802	6,434	2,296
		2002	13	12	46	204	169	82.8	88	43.1	3.605	15,827	4,390
		All	29	24	268	651	506	77.7	283	43.5	3.224	38,296	11,878
	543	1998	2	0	1	3	2	66.7	0	0.0	.	.	.
		2000	2	1	23	41	33	80.5	6	14.6	.	.	.
		2001	2	1	5	5	4	80.0	3	60.0	.	.	.
		2002	4	1	17	44	35	79.5	7	15.9	.	.	900
		All	6	2	46	93	74	79.6	16	17.2	.	.	2,082
Rockfish	541	1998	6	0	11	22	7	31.8	0	0.0	.	.	1,146
		1999	5	2	19	39	18	46.2	4	10.3	.	.	2,172
		2000	5	2	13	34	27	79.4	2	5.9	.	.	1,556
		2001	4	2	54	48	34	70.8	3	6.3	.	.	1,472
		2002	5	3	24	52	20	38.5	7	13.5	4.834	8,483	1,755
		All	10	6	121	195	106	54.4	16	8.2	1.293	10,474	8,101
	542	1998	5	0	8	38	29	76.3	0	0.0	.	.	1,588
		1999	6	4	17	47	45	95.7	15	31.9	1.586	3,559	2,245
		2000	5	3	23	40	32	80.0	7	17.5	1.298	2,136	1,646
		2001	5	3	43	40	17	42.5	4	10.0	0.170	179	1,057
		2002	5	4	23	47	25	53.2	18	38.3	1.715	3,046	1,776
		All	9	7	114	212	148	69.8	44	20.8	1.073	8,921	8,312
	543	1998	5	3	17	56	33	58.9	5	8.9	0.512	1,676	3,273
		1999	4	2	19	90	68	75.6	10	11.1	.	.	5,546
		2000	6	3	25	72	55	76.4	13	18.1	2.136	7,574	3,547
		2001	4	2	12	30	20	66.7	8	26.7	.	.	2,135
		2002	5	5	25	67	52	77.6	32	47.8	13.91	44,989	3,235
		All	8	6	98	315	228	72.4	68	21.6	5.629	99,826	17,736

rom NPFMC EFH Observer Report File, April 2003
A '.' denotes confidential data
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Table H-11. Observed Aleutian Islands Trawl Bryozoan and Coral Bycatch by Target Species and Federal Zone, 1998-2002 (by Regulatory Area)

Weekly Target Species	Zone	Year	Observed Vessels	Vessels W/ Bryozoan bycatch	Un-sampled Hauls	Total Sampled Hauls	Hauls with Bycatch	%	Hauls W/ Bryozoan Bycatch	%	Bryozoan Bycatch Rate (kg/ton)	Observed Bryozoan Bycatch (kg)	Target Species (mtons)
Atka Mackeral	ALL	1998	10	6	434	1046	560	53.5	44	4.2	0.118	4,874	41,355
		1999	10	9	384	1073	733	68.3	100	9.3	0.071	2,978	41,702
		2000	9	9	283	906	590	65.1	127	14.0	0.167	6,491	38,828
		2001	9	9	338	1031	674	65.4	158	15.3	0.200	9,775	48,813
		2002	10	10	62	912	617	67.7	126	13.8	0.174	7,175	41,295
		All	14	13	1501	4968	3174	63.9	555	11.2	0.148	31,293	211,993
Pacific Cod	ALL	1998	19	11	336	477	284	59.5	60	12.6	****	****	****
		1999	15	10	149	485	390	80.4	75	15.5	0.115	1,367	11,887
		2000	30	15	246	782	469	60.0	76	9.7	****	****	****
		2001	20	9	186	568	404	71.1	107	18.8	****	****	****
		2002	25	12	306	904	509	56.3	101	11.2	0.465	7,940	17,079
		All	58	36	1223	3216	2056	63.9	419	13.0	0.410	24,599	59,982
Rockfish	ALL	1998	6	2	36	116	69	59.5	7	6.0	.	.	****
		1999	7	4	55	176	131	74.4	18	10.2	3.292	32,794	9,963
		2000	6	5	61	146	114	78.1	15	10.3	****	****	****
		2001	5	3	109	118	71	60.2	11	9.3	0.232	1,081	4,664
		2002	5	3	72	166	97	58.4	22	13.3	0.097	658	6,767
		All	11	7	333	722	482	66.8	73	10.1	1.208	41,234	34,149

From NPFMC EFH Observer Report File, April 2003
A '.' denotes confidential data
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Table H-12. Observed Aleutian Islands Trawl Sponge Bycatch by Target Species and Federal Zone, 1998-2002 (All Regulatory Areas)

Weekly Target Species	Zone	Year	Observed Vessels	Vessels W/ Sponge bycatch	Un-sampled Hauls	Total Sampled Hauls	Hauls with Bycatch	%	Hauls W/ Sponge Bycatch	%	Sponge Bycatch Rate (kg/ton)	Observed Sponge Bycatch (kg)	Target Species (mtons)
Atka Mackeral	ALL	1998	10	8	434	1046	560	53.5	238	22.8	0.938	38,769	41,355
		1999	10	10	384	1073	733	68.3	454	42.3	1.696	70,715	41,702
		2000	9	9	283	906	590	65.1	301	33.2	0.619	24,044	38,828
		2001	9	9	338	1031	674	65.4	259	25.1	0.524	25,581	48,813
		2002	10	10	62	912	617	67.7	284	31.1	1.547	63,874	41,295
		All	14	13	1501	4968	3174	63.9	1536	30.9	1.052	222,984	211,993
Pacific Cod	ALL	1998	19	16	336	477	284	59.5	143	30.0	****	****	****
		1999	15	11	149	485	390	80.4	202	41.6	1.080	12,837	11,887
		2000	30	21	246	782	469	60.0	142	18.2	****	****	****
		2001	20	15	186	568	404	71.1	187	32.9	****	****	****
		2002	25	17	306	904	509	56.3	169	18.7	****	****	****
		All	58	45	1223	3216	2056	63.9	843	26.2	1.404	84,231	59,982
Rockfish	ALL	1998	6	3	36	116	69	59.5	5	4.3	****	****	****
		1999	7	5	55	176	131	74.4	29	16.5	3.302	32,902	9,963
		2000	6	4	61	146	114	78.1	22	15.1	****	****	****
		2001	5	3	109	118	71	60.2	15	12.7	3.945	18,396	4,664
		2002	5	5	72	166	97	58.4	57	34.3	8.352	56,519	6,767
		All	11	8	333	722	482	66.8	128	17.7	3.491	119,221	34,149

From NPFMC EFH Observer Report File, April 2003
A '.' denotes confidential data
Report2B.sas

Table H-13. Estimated Aleutian Islands Trawl Bryozoan Bycatch by Fishery and Federal Zone, 1998-2002

		FEDERAL ZONE								
		541			542			543		
Weekly Target Species	Year	Bryozoan bycatch Rate (kg/ton)	Target* Total Tons	Bryozoan Expanded (tons)	Bryozoan bycatch Rate (kg/ton)	Target* Total Tons	Bryozoan Expanded (tons)	Bryozoan bycatch Rate (kg/ton)	Target* Total Tons	Bryozoan Expanded (tons)
Atka Mackeral	1998	.	10,673	.	0.15	19,904	2.95	0.15	24,193	3.66
	1999	0.08	14,565	1.10	0.01	21,505	0.25	0.15	16,187	2.42
	2000	0.10	13,961	1.34	0.07	22,203	1.58	0.43	10,200	4.40
	2001	0.24	7,686	1.83	0.08	31,780	2.61	0.39	20,008	7.77
	2002	0.00	3,820	0.02	0.05	21,984	1.08	0.37	17,433	6.43
Pacific Cod	1998	0.51	12,642	6.45	0.37	4,003	1.48	.	.	.
	1999	0.12	13,210	1.58	0.05	642	0.03	.	.	.
	2000	0.03	13,998	0.41	0.10	2,782	0.27	.	1,378	.
	2001	0.11	9,630	1.02	0.34	3,833	1.31	.	.	.
	2002	0.10	19,305	1.99	0.50	6,084	3.06	5.02	1,207	6.05
Rockfish	1998	.	1,562	.	.	2,022	.	.	4,198	.
	1999	.	2,495	.	0.74	2,913	2.16	.	6,577	.
	2000	0.10	1,939	0.20	.	2,074	.	1.70	4,483	7.61
	2001	.	2,745	.	0.25	2,326	0.58	.	2,921	.
	2002	.	2,627	.	.	2,560	.	.	4,355	.

From NPFMC EFH Observer Report File, April 2003,and from NMFS Blend data
A '.' denotes confidential data
* Taken from blend data. CDQ and discard data are included.

Table H-14. Estimated Aleutian Islands Trawl Sponge Bycatch by Fishery and Federal Zone, 1998-2002

		FEDERAL ZONE								
		541			542			543		
Weekly Target Species	Year	Sponge bycatch Rate (kg/ton)	Target* Total Tons	Sponge Expanded (tons)	Sponge bycatch Rate (kg/ton)	Target* Total Tons	Sponge Expanded (tons)	Sponge bycatch Rate (kg/ton)	Target* Total Tons	Sponge Expanded (tons)
Atka Mackeral	1998	0.82	10,673	8.77	0.68	19,904	13.55	1.19	24,193	28.87
	1999	0.34	14,565	4.98	0.87	21,505	18.81	4.09	16,187	66.16
	2000	0.69	13,961	9.56	0.50	22,203	11.15	0.76	10,200	7.73
	2001	0.25	7,686	1.92	0.63	31,780	20.01	0.44	20,008	8.76
	2002	0.08	3,820	0.30	0.25	21,984	5.52	3.51	17,433	61.20
Pacific Cod	1998	3.78	12,642	47.75	1.89	4,003	7.55	.	.	.
	1999	0.87	13,210	11.45	3.86	642	2.48	.	.	.
	2000	0.26	13,998	3.66	4.17	2,782	11.60	.	1,378	.
	2001	0.32	9,630	3.05	2.80	3,833	10.74	.	.	.
	2002	0.29	19,305	5.56	3.61	6,084	21.93	.	1,207	.
Rockfish	1998	.	1,562	.	.	2,022	.	0.51	4,198	2.15
	1999	.	2,495	.	1.59	2,913	4.62	.	6,577	.
	2000	.	1,939	.	1.30	2,074	2.69	2.14	4,483	9.57
	2001	.	2,745	.	0.17	2,326	0.39	.	2,921	.
	2002	4.83	2,627	12.70	1.71	2,560	4.39	13.91	4,355	60.56

From NPFMC EFH Observer Report File, April 2003,and from NMFS Blend data
A '.' denotes confidential data
* Taken from blend data. CDQ and discard data are included.

Table H-15. Bycatch Limit Results

Fishery	541	542	543
Atka mackerel	10	20	66
Sponge	10	20	66
Coral/bryozoans	2	3	8
Pacific cod			
Sponge	11	22	22
Coral/bryozoans	2	1	6
Rockfish			
Sponge	13	5	10
Coral/bryozoans	1	1	8

There are other ways to estimate bycatch of corals/bryozoans and sponges. Galen Tromble from the NMFS in-season management program noted that if NMFS scientists had to make estimates of catch for these organisms, they would apply the same methodology used for PSC estimates. The rates are generated by dividing the EXTRAPOLATED_WEIGHT (this is a column in the observer data) of the species in question by the total of the EXTRAPOLATED_WEIGHT of the GROUNDFISH SPECIES in the haul. Therefore, the denominator would not be the OTC, the weight of just the 'target' species, or the sum of all the extrapolated weights—just those of the FMP groundfish species. Mr. Tromble further noted that when establishing a proposed "cap" setting, the results would likely be reasonably accurate, but that they would not exactly match the methodology that NMFS uses to monitor.

H.19 Use of the AKFIN Database for Community/Social Assessment

The goal of the social or community-oriented description of the status quo and analysis of the range of alternatives is to describe the number and distribution (in terms of communities) of fisheries participants (harvesters and processors), the patterns of their fisheries activities, and the level of their fisheries participation for each of the alternatives. For quantitative analysis purposes, the status quo alternative is used as the base case, and differences between the characteristics of this alternative and each of the other alternatives are discussed as potential effects of the proposed actions defining that alternative. Of central importance is an assessment of changes in engagement and dependency on the relevant fisheries.

Limitations of the Analysis

Several methodological challenges to the analysis were met in the following ways:

- The base year for the community and social fisheries activity description and analysis (as for other analyses) is 2001, due to its being the most recent year for which complete information is available. Using a single year as a base case is inherently challenging due to normal year-to-year fluctuations in the overall fishery(ies) as well as variations in the annual patterns of activity, but comparisons with prior years proved problematic, both for methodological reasons (changing boundaries of ADF&G groundfish statistical areas) and for practical reasons (time constraints). One additional complication is introduced by the fact that the status quo alternative is based on 2001 fisheries activities as constrained by 2002/2003 spatial management (Steller Sea Lion RPAs). Thus, the “status quo” is an analytical construction like the other alternatives, which are essentially 2001 fisheries activities as constrained by the management actions proposed under each specific alternative.

- To establish a linkage between fisheries participants and communities, we have assumed that for harvesters the community of reference (that place or social collective most likely to be affected by changes in the fisheries activities of the harvesters in question) is the official (documented)

community of residence of the owner (or the majority owner in the case of multiple ownership) of the harvesting entity. While this assumption has the advantage of being a practical way to assign a direction to the "flow" of revenues or related impacts on a community basis, caution is needed in interpretation of the results.. For example, even if the owner of a vessel is a resident of one community, substantial benefits can and do accrue to other communities, as skipper and crew may live elsewhere, deliveries may be made in any number of locations, vessel service and repair work may take place in yet another community, and so on. Further, the official address of a harvesting business may not represent the domicile of the owner at all, but rather may be a location chosen for documentation based on a number of business related factors. For catcher-processors, the community of reference used is also the documented address of the owner of the vessel, and the same caveats apply. For shoreplants, the community of reference is taken to be the physical location of the plant, due to the local importance of the activities (especially for municipal revenue related impacts). Despite these known shortcomings in terms of precise quantification of outcomes, the results of the analysis do provide useful indicators of the likely nature, direction, and magnitude of community level change associated with the alternatives. The methods and assumptions used for these analyses also have the advantage of being consistent with those used for other similar and recent analyses, such as those included in the Steller sea lion resource protection measures SEIS, the revised draft programmatic groundfish SEIS, and the crab rationalization EIS.

- Issues of confidentiality of information impose practical limits on the discussion of potential effects on a community basis, since it is not unusual for there to be fewer than four unique entities, especially for processors, in any given community. Even if there are more than four harvesting entities from a community, their distribution by sector or their pattern of delivery of harvest (if to fewer than four unique processors) can require that their information be used only in ways that protect the confidentiality of any single entity. As a result, much of the community and social analysis is presented on a regional basis.

- Information for and about different entities, even when apparently measuring the same variable, may not be strictly comparable. In terms of comparing total values, for example, catcher vessels generally have their catch reported in terms of ex vessel value, while seemingly analogous catcher processor catch data are provided in terms of first wholesale price. The data are more useful for examining relative values, establishing rough comparisons and rankings of effects, and identifying overall trends than for focusing exact values derived for any particular variable examined. The data sets used for the community and social impacts analysis were compiled and provided by members of the EFH analytical team. Documentation of these data sets indicate that the data sets are the result of combining information that in other contexts would be considered incongruous or not strictly comparable (Alaska Fisheries Information Network 2003a, 2003b). None contain all of the same information, and so each file illuminates a different aspect of the data in the absence of a comprehensive fisheries database.

Community/Social Assessment

The five data sets of central relevance to the community/social impact analysis were the "EFH harvest vessel diversification" file, the "EFH processor diversification" file, and the individual "EFH harvest/processor" files for crab, halibut, and scallops. The vessel and processor diversification files were used for all alternatives and their data are focused on groundfish. The crab, halibut, and scallop files were used in conjunction with the other two files in the Alternative 6 analysis. The vessel and processor diversification files are both designed as broad and comprehensive data sets, but have limitations. The vessel diversification file presents information on the number of vessels and their total harvest for all fisheries by community. However, this file does not include the regionalization or

localization information for potentially affected groundfish harvests, and includes only those vessels that harvested groundfish in 2001 in an area potentially closed by one of the alternatives under consideration. Thus, it is a tool to approximate the effects of alternatives on communities (and regions) due to effects on the groundfish fleet. In the case of Alternatives 1 through 5, where only groundfish fisheries would experience direct impacts, this is a useful simplification.

Further, "revenue at risk", although known for regions as a whole, cannot be explicitly assigned to community fleets since harvest regionalization was not maintained in this file. Only the community and social analysis attempts to link vessels and harvest to communities, so this information is not available from other portions of the EFH analysis. Local knowledge ("on-the-ground" information about community fisheries participation patterns) provides some guidance in this area, and is used at a very general level in this document based on fieldwork associated with earlier studies. No additional fieldwork was undertaken as part of the EFH analysis.

For the groundfish fleet, the files provide information on the relative contribution of groundfish and other fisheries for communities and regions as part of total overall harvest, with numbers that are useful in attempting to sort out issues of relative dependency. For non-groundfish fisheries, the files provide only partial potential effects information for those vessels that participate in the crab, halibut, and scallop fisheries as well as groundfish fisheries.

The processor diversification file was constructed from the vessel diversification file by aggregating the total harvest for those vessels delivering to a given processor and attributing that total harvest (and not just what the vessel delivered to that particular processor) to the processor. Thus, vessels that deliver to more than one processor are counted at least as many times as processors they deliver to, so that processor volumes are overestimated. It is likely that the count and distribution information for larger processors is reasonably accurate, but similar information for smaller and more specialty-oriented processors is inflated by the "distributed catch", as discussed in the AKFIN documentation. The chosen threshold, 0.001 ton of fish, does not affect the total volume or weight of fish numbers as much as it does the numbers of participating vessels and small processors. The threshold was chosen so that it pragmatically gave results that "make sense" in terms of vessel numbers potentially affected by each alternative, but again likely inflates the number of small processors involved. Thus, the information from this file is generally most useful for the enumeration and distribution of groundfish processors by community and region. It is somewhat useful for discussing the number of different species that community/regional processors work with, and not very useful for estimating processing volume attributable to any given community or region. Such information would, in most cases, be confidential in any event, given the typically low numbers of unique processors in each community (with the few exceptions of Kodiak, Unalaska/Dutch Harbor, and some ports in Southeast Alaska for various fisheries). Count and distribution information can be (and are) used to discuss the potential effects of the alternatives, at least in relative terms.

Catcher processors appear in both of the harvester and processor diversification files and compose a relatively easily identified sector, with ownership concentrated in one region (the Pacific Northwest). As with other processors, much of the processing information for communities, other than for the largest, is confidential. Thus count and distribution information was used to support a more general discussion.

The species-specific files include data on those fleets targeting each particular species, and contain no information on other fisheries in which those vessels may also participate. As a result, these data are useful for discussing engagement in the fishery, but not relative dependency (except in the very limited sense of relative distribution within the single species itself). The file does contain harvest localization information, however, so that it can be used to estimate what percentage of a community's fleet and

processing production is from harvests that are placed "at-risk" under Alternative 6. This is clearly useful information, although it does not illuminate the importance of the specific fishery to the local fleet. These files proved most useful for crab- and halibut-related analyses, because most of the scallop fishery information is confidential.

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AKFIN. 2003b. AKFIN Documentation: Commercial Harvest of Crab, Halibut, Herring and Scallops by State Statistical Area, Submitted to NOAA Fisheries Alaska Region, for Essential Fish Habitat, Draft Environmental Impact Statement June 10, 2003. PSMFC, AKFIN, 612 W. Willoughby, Suite B., Juneau, AK 99801.

MAPS

Example maps indicating redistribution of fishing effort appear on the following pages. A complete set of the 70+ maps used in the analysis is provided on the CD-ROM version of the EIS.