Table B.2-1. Effects of I (=q*f) and Rho Parameters on Estimates of Long-term Habitat Reduction

Habitat Effect (Percent Reduction)										
Recovery	**Avg. Effect Rate (I)**									**Rec. Time**
Rate = D	**0.001**	**0.01**	**0.04**	**0.06**	**0.08**	**0.1**	**0.15**	**0.2**	**0.3**	**R = 1/D**
0.01	9	50	81	86	90	92	95	96	98	100
0.02	5	34	68	76	81	85	90	92	95	50
0.04	2	20	51	61	68	73	81	86	91	25
0.1	1	9	29	39	46	52	64	71	80	10
0.2	0	5	17	24	30	36	47	55	67	5
0.4	0	2	9	14	18	22	30	38	50	3
1	0	1	4	6	8	10	15	20	29	1
2	0	1	2	3	4	5	8	11	17	1
4	0	0	1	2	2	3	4	6	9	0

Table B.2-2. A Summary of the Fishing Effects Analysis Process, Including Input Data Matricies, Calculation Steps, and Output Matrices

Indices

i - block
g - fishery
j - feature
k - habitat

Input Data

Fishing Intensity matrix (f_{ig}) - proportion of each block's area swept by the gear used by each fishery in an average year.
Sensitivity matrix ($q_{g(j \bullet k)}$) - proportion by which each feature's function in each habitat is reduced by one pass of the gear used in each fishery.
Recovery matrix ($\rho_{(j \bullet k)}$) - recovery rate for the function of each habitat feature within each habitat.
Block categorization matrix (C_{ik}) - The area (km^2) of each block estimated to be within each habitat.
Area vector (A_k) - The area (km^2) covered by each habitat.

Analysis Steps

1. Multiply effort matrix (f_{ig}) and sensitivity matrix ($q_{g(j \bullet k)}$) to get effect rate matrix ($I_{i\,(j \bullet k)}$)

   $$I_{i\,(j \bullet k)} = \sum_g (q_{g(j \bullet k)} * f_{ig})$$

2. Apply effect equation to effect rate matrix ($I_{i\,(j \bullet k)}$) and recovery vector ($\rho_{(j \bullet k)}$) to get effect matrix ($Heq_{\,i\,(j \bullet k)}$)

   $$Heq_{\,i\,(j \bullet k)} = \rho_{(j \bullet k)}\, S/(I_{i\,(j \bullet k)} + \rho_{(j \bullet k)}\, S), \qquad \text{where } S = e^{-Ii\,(j \bullet k)}$$

3. Multiply 1 minus each cell of the effect ($Heq_{\,i\,(j \bullet k)}$) matrix by the corresponding cell of the block categorization matrix (C_{ik}) to get the proportional decrease of that feature in that habitat type occurring in that block , long-term effect index($LEI_{\,i\,(j \bullet k)}$)

   $$LEI_{\,i\,(j \bullet k)} = (1 - Heq_{\,i\,(j \bullet k)}) * C_{ik}$$

4. Sum $E_{\,i\,(j \bullet k \bullet d)}$ matrix across blocks (i) and divide by the total area of each habitat type (A_k) to get the total proportional decrease of that feature in that habitat type ($LEI_{(j \bullet k)}$)

   $$LEI_{(j \bullet k)} = \sum_i LEI_{\,i\,(j \bullet k)} / A_k$$

Output - Long-term Effect Index ($LEI_{\,i\,(j \bullet k)}$, $LEI_{\,(j \bullet k)}$)

The proportion by which habitat is reduced (adverse effect) for each habitat feature for each block and across each habitat type if recent fishery intensity and distribution were continued at current levels to equilibrium.

Table B.2-3. Fisheries Considered in the Analysis of Fishing Effects on Essential Fish Habitat

Target	Gear
Bering Sea	
Scallop*	Dredge
Red King Crab*	Pot
Tanner Crab*	Pot
Snow Crab*	Pot
Flathead Sole and Other Flatfish	Bottom Trawl
Cod	Bottom Trawl
Pollock	Bottom Trawl
Rock Sole	Bottom Trawl
Rockfish	Bottom Trawl
Sablefish / Turbot	Bottom Trawl
Yellowfin sole	Bottom Trawl
Pollock	Pelagic Trawl
Cod	Longline
Sablefish / Turbot	Longline
Cod	Pot
Cod*	Jig
Aleutians	
Red King Crab*	Pot
Golden King Crab*	Pot
Atka Mackerel	Bottom Trawl
Cod	Bottom Trawl
Pollock	Bottom Trawl
Rockfish	Bottom Trawl
Sablefish/Turbot	Trawl
Pollock	Pelagic Trawl
Cod	Longline
Sablefish/Turbot	Longline
Cod	Pot
Gulf of Alaska	
Shallow Flatfish	Bottom Trawl
Rockfish	Bottom Trawl
Rockfish	Pelagic Trawl
Pollock	Bottom Trawl
Pollock	Pelagic Trawl
Cod	Bottom Trawl
Cod	Pot
Cod	Longline
Sablefish/Turbot	Longline
Deep Flatfish	Bottom Trawl
Cod*	Jig

* Not included in detailed analysis

Table B.2-4. Derivation of Fishing Effort Adjustments from Units Recorded by Observers to km ^{2}

Gear	Vessel Class (feet)	Width (meters)	Speed (knots)	Observer Coverage	Distance (m)	Distance per Hook (m)	Proportion on Bottom	Unit	Area (km^2)/Unit
Bottom Trawl	Gt 125	166	3.6	1	N/A	N/A	1	hour	1.11
	Lt 125	90	3.3	0.32	N/A	N/A	1	hour	1.72
Rough Bottom Trawls (Aleutian)	Gt 125	50	3.6	1	N/A	N/A	1	hour	0.33
	Lt 125	50	3.3	0.32	N/A	N/A	1	hour	0.95
Pelagic Trawl	Gt 125	136	3.9	1	N/A	N/A	0.44	hour	0.43
	Lt 125	75	3.5	0.23	N/A	N/A	0.44	hour	0.93
Longline	Gt 125	2	N/A	1	N/A	1.28	1	hook	0.000003
	Lt 125	2	N/A	0.3	N/A	1.28	1	hook	0.000009
Pot	All	2.13	N/A	0.3	4.26	N/A	1	pot	0.000030

Notes: km - kilometer; m - meter; km^2 - square kilometer; GT - greater than; LT - less than

Table B.2-5. Estimates of the Q Parameter Used in the Analysis of Fishing Effects on Essential Fish Habitat

	Low Effect Estimate %	Central Estimate %	High Effect Estimate %	Quality Score	Comments
Bottom Trawls					
Infaunal prey	5	11	21	6	several related studies
Soft Substrates					
Epifaunal prey	4	10	17	6	several related studies
Living structure	1	15	21	5	some related studies
Non-living structure	0	2	5	4	value metric vague
Hard Substrates					
Epifaunal prey	16	18.5	22	5	some related studies
Living structure	10	20	30	5	some related studies
Non-living structure	1	2	5	4	value metric vague
Hard corals	22	27	35	4	few related studies
Pelagic Trawls (when contacting seafloor)					
Soft Substrates					
Infaunal prey	4	21	36	4	two related studies
Epifaunal prey	4	16.5	25.5	2	indirect rationale
Living structure	10	20	30	2	indirect rationale
Non-living structure	10	20	30	2	indirect rationale
Hard Substrates	0, not used on hard substrates (effort rescaled to reflect all efforts on soft portion)				
Longlines					
Infaunal prey		0.05		3	rationale for low effect
Soft Substrates					
Epifaunal prey		0.05		3	rationale for low effect
Living structure		5		1	very indirect rationale
Non-living structure		0.05		3	rationale for low effect
Hard Substrates					
Epifaunal prey		0.05		3	rationale for low effect
Living structure		10		1	very indirect rationale
Non-living structure		0.05		2	indirect rationale
Hard coral		0.05		1	very indirect rationale
Pots					
Infaunal prey		26		2	indirect rationale
Epifaunal prey		21.5		1	very indirect rationale
Living structure		25		1	very indirect rationale
Non-living structure		25		1	very indirect rationale
Hard coral		35		1	very indirect rationale

Table B.2-6. Estimates of the Rho Parameter Used in the Analysis of Fishing Effects on Essential Fish Habitat

Substrate	Habitat Features	Low Effect Estimate %	Central Estimate %	High Effect Estimate %	Quality Score
Sand (soft substrate)	Infaunal prey	8	4	3	4
	Epifaunal prey	8	4	3	4
	Living shelter	0.26	0.18	0.1	2
	Non-living shelter	8	2	1	3
Mud - sand mix (soft substrate)	Infaunal prey	2	1.33	1	4
	Epifaunal prey	2	1.33	1	4
	Living shelter	0.26	0.18	0.1	2
	Non-living shelter	2	1	0.66	4
Mud - silt (soft substrate)	Infaunal prey	2	1	0.66	4
	Epifaunal prey	2	1	0.66	4
	Living shelter	0.26	0.18	0.1	2
	Non-living shelter	2	0.5	0.33	3
Pebble to rock (hard substrate)	Infaunal prey	2	1	0.66	3
	Epifaunal prey	2	1	0.66	3
	Living shelter	0.09	0.05	0.01	3
	Non-living shelter	0.02	0.01	0.005	3
	Hard coral	0.02	0.01	0.005	3

Table B.2-7. Areas of Habitat Types Used in the Analysis of Fishing Effects on Essential Fish Habitat

Habitat Type	Area (km^2)	Split Percent	Quality Score
Bering Sea			
Sand	265,099	N/A	7
Sand/mud	294,244	N/A	7
Mud	97,058	N/A	7
Norton Sound +	103,091	N/A	7
Slope	25,762	N/A	7
Bering Sea Total	**785,254**	**N/A**	
Aleutians			
Shallow			3
Sand	8,378	20%	1
Hard	33,510	80%	1
Shallow total	41,117	100%	3
Deep			
Sand/mud	13,760	20%	1
Hard	55,042	80%	1
Deep total	68,802	100%	3
AleutianTotal	**109,919**	**N/A**	
Gulf of Alaska			
Shallow			
Sand	106,310	81%	1
Hard	24,937	19%	1
Shallow total	131,247	100%	3
Shelf Deeps			
Sand/mud	143,900	95%	1
Hard	7,574	5%	1
Shelf deep total	151,474	100%	3
Slope			
Sand/mud	37,647	90%	1
Hard	4,183	10%	1
Slope total	41,830	100%	3
Gulf of Alaska Total	**324,550**	**N/A**	
Grand Total	**1,175,801**	**N/A**	

Table B.2-8. Proportions of Shelf Area (<1,000 m) in Blocks Experiencing Different Levels of Combined Fishing Intensity (1998 to 2002).

	Unfished	Untrawled	Block Intensity1				
Region	**blocks**	**blocks**	**< 0.1**	**0.1 - 0.5**	**0.5 - 1**	**1.0-2.0**	**>2.0**
Bering Sea	61.3%	68.8%	82.1%	12.1%	3.4%	1.7%	0.8%
Aleutian Islands	47.0%	78.3%	93.3%	4.8%	1.1%	0.5%	0.3%
Gulf of Alaska	64.0%	74.2%	89.6%	7.9%	1.6%	0.6%	0.3%

[1] Total area per year of all fishing ending in each block divided by block area

Table B.2-9. Long-term Effect Indices (LEI* in % reduction) for Fishing Effects on Benthic Habitat Features of Alaska Marine Waters by Habitat Type (low and high LEIs in parentheses)

	Soft Substrates (mud - gravel)									Hard Substrates (pebble - rock)				
Habitat	**Bering Sea**			**Aleutians**			**Gulf of Alaska**			**Aleutians**		**Gulf of Alaska**		
Features	**Sand**	**Sand/Mud**	**Mud**	**Slope**	**Shallow**	**Deep**	**Shallow**	**Deep Shelf**	**Slope**	**Shallow**	**Deep**	**Shallow**	**Deep Shelf**	**Slope**
Infauna Prey	0 (0-1)	2 (0-4)	0 (0-0)	3 (1-7)	0 (0-1)	1 (0-2)	0 (0-1)	1 (0-1)	1 (0-2)	0 (0-1)	0 (0-0)	1 (0-1)	0 (0-1)	0 (0-1)
Epifauna Prey	0 (0-1)	2 (0-3)	0 (0-0)	3 (0-6)	0 (0-1)	1 (0-2)	0 (0-0)	0 (0-1)	0 (0-1)	1 (0-1)	0 (0-0)	1 (0-1)	1 (0-1)	1 (0-1)
Living Structure	4 (1-6)	11 (3-19)	0 (0-1)	11 (4-19)	4 (1-7)	3 (1-4)	3 (1-5)	3 (1-6)	4 (0-7)	7 (3-17)	2 (1-7)	5 (2-10)	6 (3-13)	9 (4-21)
Non-living Structure	0 (0-1)	1 (0-3)	0 (0-0)	4 (1-7)	1 (0-1)	0 (0-0)	0 (0-1)	0 (0-1)	0 (0-1)	5 (5-11)	2 (1-4)	3 (1-7)	4 (2-9)	5 (2-14)
Hard Coral	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	16 (11-20)	6 (4-9)	10 (8-12)	13 (10-16)	20 (14-25)

* LEI - Estimated eventual reduction in a class of habitat feature if recent fishing intensity and distribution were continued until fishing effect rates and habitat recovery rates equalized (equilibrium).

Table B.2-10. Long-term Effect Indicies (LEI*) Indicating the Effects of Fishing on Habitat Features by Fishery for the Features with the Highest LEIs in Each Region

Bering Sea (soft substrate)	Sand/Mud Biostructure	Slope Biostructure
Pollock Pelagic Trawl	4.6%	7.2%
Yellowfin Sole Trawl[1]	2.9%	0.2%
Flathead Sole/Flatfish Trawl[1]	1.8%	1.6%
Rock Sole Trawl[1]	0.9%	0.2%
Pollock Bottom Trawl[1]	0.4%	0.6%
Pacific Cod Trawl[1]	0.2%	0.4%
Sablefish/Turbot Trawl[1]	0.1%	0.7%
Pacific Cod Longline	0.0%	0.0%
Rockfish Trawl[1]	0.0%	0.0%
Pot	0.0%	0.0%
Sablefish/Turbot Longline	0.0%	0.0%
Total	**10.9%**	**10.9%**
[1] Total Bottom Trawl	6.3%	3.7%

Gulf of Alaska (hard substrate)	Slope Biostructure
Rockfish BottomTrawl	4.2%
Deep-water Flatfish Trawl	4.1%
Pacific Cod Trawl	0.2%
Shallow-water Flatfish Trawl	0.1%
Sablefish/Turbot Longline	0.1%
Pollock Bottom Trawl	0.0%
Pacific Cod Longline	0.0%
Pot	0.0%
Pollock Pelagic Trawl	0.0%
Rockfish Pelagic Trawl	0.0%
Total	**8.7%**

Aleutian Islands (hard substrate)	Shallow Biostructure
Pacific Cod Trawl	4.2%
Atka Mackeral Trawl	2.5%
Sablefish/Turbot Trawl	0.2%
Rockfish Trawl	0.2%
Pollock Bottom Trawl	0.1%
Pacific Cod Longline	0.1%
Sablefish/Turbot Longline	0.0%
Pot	0.0%
Pollock Pelagic Trawl	0.0%
Total	**7.3%**

* LEI - Estimated eventual reduction in a class of habitat feature if recent fishing intensity and distribution were continued until fishing effect rates and habitat recovery rates equalized (equilibrium).

Table B.3-1 Connections Between Life Stages of Managed Species and Habitat Features and Types Used in the Fishing Effects Analysis

Species & Life Stage		Soft Substrates									Hard Substrates					Any Substrate Any Region
		Bering Sea				Aleutian Islands		Gulf of Alaska			Aleutian Islands		Gulf of Alaska			
		Sand	Sand/Mud	Mud	Slope	Shallow	Deep	Shallow	Deepshelf	Slope	Shallow	Deep	Shallow	Deepshelf	Slope	Any Habitat
Red king crab									*					*		
egg	attached to female															
larvae	pelagic															
juvenile	benthic	**C, D**				**C**					**C**					**C,D**
adult	benthic	**A,B**	**A,B**			**A,B**					**A,B**					**A,B**
Blue king crab									*					*		
egg	attached to female															
larvae	pelagic															
juvenile	benthic	**C, D**	**C, D**													**C,D**
adult	benthic	**A,B**	**A,B**													**A,D**
Golden king crab									*					*		
egg	attached to female															
larvae	pelagic															
juvenile	benthic				**D**		**D**					**D**				**D**
adult	benthic				**A,B,C,D**		**A,B,C,D**					**A,B,C,D**				**A,B,C,D**
Scarlet king crab									*					*		
egg	attached to female															
larvae	pelagic															
juvenile	benthic				unknown		unknown					unknown				
adult	benthic				unknown		unknown					unknown				
Tanner crab									*					*		
egg	attached to female															
larvae	pelagic															
juvenile	benthic		**A,B**	**A,B**		**A,B**					**A,B**					**A,B**
adult	benthic		**A,B**	**A,B**		**A,B**					**A,B**					**A,B**
Snow crab									*					*		
egg	attached to female															
larvae	pelagic															
juvenile	benthic		**A,B**	**A,B**												**A,B**
adult	benthic		**A,B**	**A,B**												**A,B**
Deepwater Tanner crab									*					*		
egg	attached to female															
larvae	pelagic															
juvenile	benthic				unknown		unknown					unknown				
adult	benthic				unknown		unknown					unknown				
Walleye pollock																
egg	demersal															
larvae	pelagic															
juvenile	demersal/semi-pelagic															
adult	demersal/semi-pelagic															

Table B.3-1 Connections Between Life Stages of Managed Species and Habitat Features and Types Used in the Fishing Effects Analysis (cont.)

Species & Life Stage		Soft Substrates									Hard Substrates					Any Substrate Any Region
		Bering Sea				Aleutian Islands		Gulf of Alaska			Aleutian Islands		Gulf of Alaska			
		Sand	Sand/Mud	Mud	Slope	Shallow	Deep	Shallow	Deepshelf	Slope	Shallow	Deep	Shallow	Deepshelf	Slope	Any Habitat
Pacific cod																
egg	demersal															
larvae	pelagic															
juvenile	demersal	**A,B**	**A,B**	**A,B**		**A,B**	**A,B**	**A,B**	**A,B**		**A,B**		**A,B**	**A,B**		**A,B**
adult	demersal	**A,B**	**A,B**	**A,B**	**A,B**	**A,B**	**A,B**	**A,B**	**A,B**	**A,B**	**A,B**	**A,B**	**A,B**	**A,B**	**A,B**	**A,B**
Sablefish																
egg	pelagic															
larvae	epipelagic															
juvenile	pelagic nearshore, then bent	**A,B**	**A,B**	**A,B**		**A,B**		**A,B**	**A,B**		**A,B**		**A,B**	**A,B**		**A,B**
adult	benthic slope				**A,B**		**A,B**			**A,B**		**A,B**			**A,B**	**A,B**
Atka mackerel																
egg	deposited in benthic nests										**D**		**D**[1]			**D**
larvae	pelagic															
juvenile	pelagic/benthic										**D**			**D**		**D**
adult	pelagic/benthic										**C,D,E**			**C,D,E**		**C,D,E**
1 / Atka mackerel nests with eggs have not been observed in the GOA, but the assumption is made that eggs would be found in the same substrate as observed in the AI.																
BSAI yellowfin sole									*					*		
egg	pelagic															
larvae	pelagic															
juvenile	benthic	**B**				**B**					**B**					**B**
adult	benthic	**A,B**	**A,B**			**A,B**					**A,B**					**A,B**
BSAI Greenland turbot									*					*		
egg	pelagic															
larvae	pelagic															
juvenile	benthic	**B**	**B**			**B**										**B**
adult	benthic	**A,B**	**A,B**		**A,B**	**A,B**	**A,B**				**A,B**	**A,B**				**A,B**
BSAI arrowtooth flounder									*					*		
egg	pelagic															
larvae	pelagic															
juvenile	benthic	**B**				**B**					**B**					**B**
adult	benthic	**A,B**	**A,B**		**A,B**	**A,B**	**A,B**				**A,B**	**A,B**				**A,B**
GOA arrowtooth flounder																
egg	pelagic															
larvae	pelagic															
juvenile	benthic							**B**					**B**			**B**
adult	benthic							**A,B**	**A,B**	**A,B**			**A,B**	**A,B**	**A,B**	**A,B**
BSAI rock sole									*					*		
egg	benthic															
larvae	pelagic															
juvenile	benthic	**B**				**B**					**B**					**B**
adult	benthic	**A,B**	**A,B**			**A,B**					**A,B**					**A,B**

Table B.3-1 Connections Between Life Stages of Managed Species and Habitat Features and Types Used in the Fishing Effects Analysis (cont.)

Species & Life Stage		Soft Substrates									Hard Substrates					Any Substrate Any Region
		Bering Sea				Aleutian Islands		Gulf of Alaska			Aleutian Islands		Gulf of Alaska			
		Sand	Sand/Mud	Mud	Slope	Shallow	Deep	Shallow	Deepshelf	Slope	Shallow	Deep	Shallow	Deepshelf	Slope	Any Habitat
Flathead sole																
egg	pelagic															
larvae	pelagic															
juvenile	benthic	**B**				**B**		**B**			**B**		**B**			**B**
adult	benthic	**A,B**	**A,B**			**A,B**		**A,B**	**A,B**		**A,B**		**A,B**	**A,B**		**A,B**
GOA rex sole																
egg	pelagic															
larvae	pelagic															
juvenile	benthic							**B**					**B**			**B**
adult	benthic							**A,B**	**A,B**				**A,B**	**A,B**		**A,B**
BSAI Alaska plaice									*					*		
egg	polagic															
larvae	pelagic															
juvenile	benthic	**B**				**B**					**B**					**B**
adult	benthic	**A,B**	**A,B**			**A,B**					**A,B**					**A,B**
GOA shallow water flatfish																
egg	benthic/pelagic															
larvae	pelagic															
juvenile	benthic							**B**					**B**			**B**
adult	benthic							**A,B**					**A,B**			**A,B**
GOA deep water flatfish																
egg	pelagic															
larvae	pelagic															
juvenile	benthic								**B**	**B**				**B**	**B**	**B**
adult	benthic								**A,B**	**A,B**				**A,B**	**A,B**	**A,B**
Pacific Ocean Perch																
egg	NA															
larvae	pelagic															
juvenile	demersal				**C,D**	**C,D**	**C,D**				**C,D**	**C,D**	**C,D**	**C,D**	**C,D**	**C,D**
adult	demersal				**D**	**D**	**D**		**C,D**	**C,D**	**D**	**D**		**C,D**	**C,D**	**C,D**
Rougheye/Shortraker																
egg	NA															
larvae	pelagic															
juvenile	demersal				**A,C,D**	**A,C,D**	**A,C,D**	**A,C,D**	**A,C,D**		**A,C,D**	**A,C,D**	**A,C,D**	**A,C,D**		**A,C,D**
adult	demersal				**A,C,D**		**A,C,D**					**A,C,D**			**C,D,E**	**A,C,D,E**
Northern Rockfish																
egg	NA															
larvae	pelagic															
juvenile	demersal				**C,D**	**C,D**		**C,D**	**C,D**		**C,D**		**C,D**	**C,D**		**C,D**
adult	demersal				**D**	**D**		**D**	**D**		**D**		**D**	**D**		**D**

Table B.3-1 Connections Between Life Stages of Managed Species and Habitat Features and Types Used in the Fishing Effects Analysis (cont.)

Species & Life Stage		Soft Substrates									Hard Substrates					Any Substrate Any Region
		Bering Sea				Aleutian Islands		Gulf of Alaska			Aleutian Islands		Gulf of Alaska			
		Sand	Sand/Mud	Mud	Slope	Shallow	Deep	Shallow	Deepshelf	Slope	Shallow	Deep	Shallow	Deepshelf	Slope	Any Habitat
GOA Light dusky rockfish			*			*					*					
egg	inside female															
larvae / postlarv	pelagic															
young juvenile	unknown															
older juvenile	demersal							C,D	C,D				C, D, E	C, D, E		C,D,E
adult	demersal								C,D					C, D		C,D
BSAI Dusky Rockfish			*			*					*					
egg	inside female															
larvae / postlarv	pelagic															
young juvenile	unknown															
older juvenile	demersal										C, D, E	C, D, E				C,D,E
adult	demersal				C, D							C, D				C,D
BSAI Shortspine Thornyheads			*			*					*					
egg	pelagic															
larvae / postlarv	pelagic															
young juvenile	unknown															
older juvenile	demersal				C, D							C, D, E				C,D,E
adult	demersal				C, D							C, D				C,D
Combined Tally	**Habitat Feature**	**Number of species / life stages connected with each habitat feature**														
	Epifauna prey	12	16	7	7	12	8	6	7	4	13	7	7	7	4	23
	Infauna prey	19	17	7	5	17	6	11	8	5	17	5	10	8	5	30
	Living structure	2	1		4	4	5	1	1	1	4	4	4	6	2	11
	Non-living structure	2	1		6	5	5	1	1	1	8	6	5	9	3	16
	Hard corals												1	1	1	2

* - Not an FMP species in this region (they may be managed as part of an FMP species group).

☐ - Habitat types / features with long-term effect indices > 5%.

All blank cells indicate that no connection was noted.

Key:

Habitat Feature:

- **A. epifauna prey (e.g., diverse crustaceans, ophiuroids, snails)**
- **B. infauna prey (e.g., clams, ploychaetes)**
- **C. living structure (e.g., anemones, sponges, large ascidians, soft corals)**
- **D. non-living structure (e.g., sand waves, rocks)**
- **E. hard corals (e.g., Primnoa, some gorgonians)**

Habitat Type:

Bering Sea: Sand, mixed sand and mud, and mud substrates and the outer slope (200 to 1,000 m)

Gulf of Alaska: Shallow (0 to 100 m), deeper shelf areas (100 to 300 m) and slope (200 to 1,000 m) each separated into sand to gravel (soft) substrates and (hard) pebble to rock substrates

Aleutian Islands: Shallow (0 to 200 m) and deep (200 to 1,000 m) both separated into soft and hard substrates

Table B.3-2. Criteria for Assessing the Effects of Fishing on Essential Fish Habitat

	Intensity of Effect			
Issue	**MMNT**	**MT**	**B**	**U**
Spawning/Breeding: Potential for adverse effects on the reproductive success of stocks	Effects of fishing expected to have an adverse effect on essential spawning, nursery, or settlement habitat which is more than minimal and not temporary	Fishing anticipated to have either minimal, temporary or no effects on essential spawning, nursery, or settlement habitat	Effects of fishing expected to have a positive effect on essential spawning, nursery, or settlement habitat which is more than minimal and not temporary	Magnitude and/or direction of effects unknown
Feeding: Potential for adverse effects on availability of significant prey resources for FMP species	Effects of fishing on habitat expected to have an adverse effect on essential prey availability which is more than minimal and not temporary	Fishing anticipated to have either minimal, temporary or no effects on essential prey availability.	Effects of fishing on habitat expected to have a positive effect on essential prey availability which is more than minimal and not temporary	Magnitude and/or direction of effects unknown
Growth to Maturity: Potential for changing the survival rates of managed species as they are growing to maturity	Effects of fishing on essential habitat expected to have an adverse effect on survival of fish to maturity which is more than minimal and not temporary	Fishing anticipated to have either minimal, temporary or no effects on the survival of fish to maturity	Effects of fishing on essential habitat expected to have a positive effect on survival of fish to maturity is expected which is more than minimal and not temporary	Magnitude and/or direction of effects unknown

MMNT = More than minimal and not temporary, MT = Minimal or Temporary, B = Beneficial, U = Unknown

The standard for MMNT or B ratings is that they are neither minimal nor temporary. These terms are described in more detail below. Effects based on the analysis of LEIs are intrinsically not temporary. Essential habitat is that necessary for the managed species to support a sustainable fishery and the managed species' contribution to a healthy ecosystem. For purposes of this assessment, the ability to support a sustainable fishery is to be judged on the stock's ability to produce MSY over the long term.

Additional information on minimal and temporary: The standard provided in the regulations for whether fisheries adversely affect EFH enough to require Council action is that such effects are more than minimal and not temporary. No numerical standards for minimal or temporary were provided. A commentary included with the final rule describes temporary impacts as those that are limited in duration and that allow the particular environment to recover without measurable impact. No time scale was attached to the term 'limited duration.' Therefore, the analysis of fishing effects was based on effects that would occur if current fishing levels were continued until affected habitat features reached an equilibrium level. Therefore, such effects would not be of limited duration and could persist (not recover) as long as the fishery continued at that level.

The same commentary describes minimal impacts as those that may result in relatively small changes in the affected environment and insignificant changes in ecological functions. In the EFH context, the terms 'environment' and 'function' refer to the features of the environment necessary for the spawning, breeding, feeding, and growth to maturity of the managed species and the function of those features in providing that support. Therefore, a change in a habitat feature estimated in the effects-of-fishing analysis (LEI) that would significantly change its support of the species' spawning, breeding, feeding, or growth to maturity would be considered more than minimal and not temporary.

Table B.3-3. LEIs (percent reduction) of Habitat Features within Intersections of Species Distributions and Habitat Types

			Percent Reduction (General Distribution [95%]/Concentration [75%])									
	% of Area		Infauna Prey		Epifauna Prey		Living Structure		Non-living Structure		Hard Coral	
Habitat	**(95%)**	**(75%)**	**(95%)**	**(75%)**	**(95%)**	**(75%)**	**(95%)**	**(75%)**	**(95%)**	**(75%)**	**(95%)**	**(75%)**
Red King Crab												
AI Deep	0	0	0	0	1	0	7	2	4	1	16	8
AI Shallow	2	1	0	0	0	0	6	3	3	1	17	10
BS Sand	**68**	**74**	**1**	**1**	**1**	**1**	**8**	**9**	**1**	**1**	**0**	**0**
BS Sand/Mud	**30**	**25**	**7**	**7**	**6**	**6**	**35**	**35**	**5**	**5**	**0**	**0**
BS Slope	0	0	42	0	34	0	82	0	51	0	0	0
Total	100	100	3	3	2	2	16	16	2	2	0	0
Blue King Crab												
BS Mud	**27**	**20**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
BS Sand	**17**	**32**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**
BS Sand/Mud	**57**	**48**	**1**	**0**	**0**	**0**	**4**	**1**	**1**	**0**	**0**	**0**
Total	100	100	0	0	0	0	2	0	0	0	0	0
Golden King Crab												
AI Deep	**56**	**45**	**0**	**0**	**0**	**1**	**3**	**5**	**2**	**3**	**9**	**14**
AI Shallow	**24**	**24**	**1**	**1**	**1**	**2**	**8**	**11**	**5**	**7**	**20**	**25**
BS Sand	3	11	4	3	3	3	17	17	6	6	0	0
BS Sand/Mud	1	2	1	1	1	1	8	7	1	1	0	0
BS Slope	10	18	3	4	3	3	14	15	4	4	0	0
GOA Deep Shelf	2	0	0	0	0	0	3	0	1	0	18	0
GOA Slope	4	0	1	0	1	0	5	0	2	0	21	0
GOA Shallow	0	0	0	0	0	0	0	0	0	0	0	0
Total	100	100	1	1	1	1	6	10	3	4	11	13
Tanner Crab												
AI Deep	0	0	3	0	4	0	35	0	22	0	60	0
AI Shallow	0	0	1	0	1	0	11	0	7	0	25	0
BS Mud	1	0	1	0	1	0	7	0	3	0	0	0
BS Sand	**26**	**32**	**2**	**2**	**2**	**1**	**11**	**11**	**1**	**1**	**0**	**0**
BS Sand/Mud	**71**	**68**	**3**	**4**	**2**	**3**	**15**	**20**	**2**	**3**	**0**	**0**
BS Slope	2	0	4	17	4	14	16	44	5	24	0	0
Total	100	100	3	3	2	3	14	17	2	3	0	0
Snow Crab												
BS Mud	**28**	**36**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
BS Sand	**7**	**7**	**2**	**0**	**2**	**0**	**9**	**4**	**1**	**0**	**0**	**0**
BS Sand/Mud	**65**	**57**	**2**	**1**	**2**	**1**	**10**	**7**	**1**	**1**	**0**	**0**
BS Slope	0	0	0	0	0	0	2	0	1	0	0	0
Total	100	100	1	1	1	1	7	5	1	0	0	0
Walleye Pollock												
AI Deep	6	6	0	0	0	0	3	3	2	2	7	8
AI Shallow	4	5	1	1	1	1	7	7	4	4	16	16
BS Mud	10	8	0	0	0	0	0	0	0	0	0	0
BS Sand	21	22	1	1	1	1	6	6	1	1	0	0
BS Sand/Mud	**28**	**28**	**2**	**2**	**2**	**2**	**12**	**13**	**2**	**2**	**0**	**0**
BS Slope	3	3	2	2	2	2	9	9	2	2	0	0
GOA Deep Shelf	13	13	1	1	1	1	5	5	1	1	16	16
GOA Slope	4	4	1	1	1	1	5	5	1	1	23	23
GOA Shallow	11	12	0	0	0	0	4	4	1	1	12	12
Total	100	100	1	1	1	1	7	7	1	1	5	6

Table B.3-3. LEIs (percent reduction) of Habitat Features within Intersections of Species Distributions and Habitat Types (cont.)

			Percent Reduction (General Distribution [95%]/Concentration [75%])									
	% of Area		Infauna Prey		Epifauna Prey		Living Structure		Non-living Structure		Hard Coral	
Habitat	**(95%)**	**(75%)**	**(95%)**	**(75%)**	**(95%)**	**(75%)**	**(95%)**	**(75%)**	**(95%)**	**(75%)**	**(95%)**	**(75%)**
Pacific Cod												
AI Deep	4	2	1	1	1	1	5	8	3	5	11	19
AI Shallow	4	4	1	1	1	1	8	10	5	6	19	24
BS Mud	7	6	0	0	0	0	1	1	0	0	0	0
BS Sand	21	23	1	1	1	1	6	7	1	1	0	0
BS Sand/Mud	**32**	**36**	**2**	**2**	**2**	**2**	**11**	**13**	**2**	**2**	**0**	**0**
BS Slope	2	3	2	2	2	2	10	10	3	3	0	0
GOA Deep Shelf	15	14	1	1	1	1	4	6	1	1	15	19
GOA Slope	2	1	1	2	1	1	7	9	2	2	31	43
GOA Shallow	13	12	0	0	0	0	4	5	1	1	11	15
Total	100	100	1	1	1	1	7	8	1	2	6	6
Sablefish												
AI Deep	17	10	0	0	1	1	4	5	2	3	8	12
AI Shallow	3	2	2	2	2	4	15	26	9	16	32	54
BS Sand	3	0	17	0	15	0	56	0	14	0	0	0
BS Sand/Mud	11	1	5	20	4	18	21	66	4	7	0	0
BS Slope	9	1	2	0	2	0	9	1	3	0	0	0
GOA Deep Shelf	**35**	**47**	**1**	**1**	**1**	**1**	**6**	**8**	**1**	**1**	**21**	**31**
GOA Slope	**16**	**32**	**1**	**1**	**1**	**1**	**4**	**5**	**1**	**1**	**21**	**24**
GOA Shallow	6	7	1	1	1	2	10	11	2	3	27	31
Total	100	100	2	1	2	1	9	8	2	2	14	27
Atka Mackerel												
AI Deep	**33**	**37**	**2**	**3**	**2**	**3**	**15**	**20**	**10**	**13**	**32**	**40**
AI Shallow	**44**	**50**	**1**	**2**	**2**	**3**	**14**	**20**	**8**	**13**	**30**	**40**
BS Sand	1	2	37	38	31	32	81	84	37	38	0	0
GOA Deep Shelf	8	5	0	0	0	0	3	3	0	1	20	20
GOA Slope	2	2	1	1	1	1	7	7	1	1	38	37
GOA Shallow	11	4	0	0	0	0	3	1	1	0	17	8
Total	100	100	2	3	2	4	13	20	8	12	28	37
Yellowfin Sole												
AI Deep	0	0	14	17	14	18	49	56	36	42	69	80
AI Shallow	0	0	8	8	9	9	34	37	23	23	38	39
BS Mud	1	0	0	0	0	0	0	0	0	0	0	0
BS Sand	**53**	**61**	**1**	**0**	**0**	**0**	**5**	**5**	**0**	**0**	**0**	**0**
BS Sand/Mud	**43**	**39**	**2**	**3**	**2**	**3**	**13**	**18**	**1**	**2**	**0**	**0**
BS Slope	0	0	18	17	15	15	56	56	20	18	0	0
GOA Deep Shelf	0	0	6	0	5	0	39	0	9	0	0	0
Shallow	3	0	0	0	0	0	3	2	1	0	6	1
Total	100	100	1	2	1	1	8	10	1	1	0	0

Table B.3-3. LEIs (percent reduction) of Habitat Features within Intersections of Species Distributions and Habitat Types (cont.)

			Percent Reduction (General Distribution [95%]/Concentration [75%])									
	% of Area		Infauna Prey		Epifauna Prey		Living Structure		Non-living Structure		Hard Coral	
Habitat	**(95%)**	**(75%)**	**(95%)**	**(75%)**	**(95%)**	**(75%)**	**(95%)**	**(75%)**	**(95%)**	**(75%)**	**(95%)**	**(75%)**
Greenland Turbot												
AI Deep	11	6	0	1	0	1	3	5	2	3	7	9
AI Shallow	4	2	1	2	1	3	11	15	7	9	23	26
BS Mud	18	14	0	0	0	0	0	1	0	0	0	0
BS Sand	6	4	5	11	4	10	21	39	4	9	0	0
BS Sand/Mud	**56**	**65**	**2**	**3**	**2**	**2**	**12**	**14**	**2**	**2**	**0**	**0**
BS Slope	5	9	2	2	2	2	9	9	2	2	0	0
GOA Deep Shelf	0	0	2	0	2	0	11	0	3	0	51	0
GOA Slope	0	0	4	0	3	0	18	0	6	0	53	0
GOA Shallow	0	0	0	0	0	0	0	0	0	0	1	0
Total	100	100	2	2	2	2	9	12	2	3	2	1
Arrowtooth Flounder												
AI Deep	6	2	1	2	1	2	5	11	3	7	11	21
AI Shallow	4	1	1	2	1	3	10	23	6	14	22	42
BS Mud	1	0	1	2	1	1	4	9	1	3	0	0
BS Sand	7	4	3	10	3	8	20	39	3	8	0	0
BS Sand/Mud	**33**	**34**	**3**	**4**	**2**	**3**	**16**	**20**	**2**	**3**	**0**	**0**
BS Slope	**3**	**5**	**2**	**3**	**2**	**2**	**10**	**12**	**3**	**3**	**0**	**0**
GOA Deep Shelf	**24**	**35**	**1**	**1**	**1**	**1**	**4**	**5**	**1**	**1**	**13**	**17**
GOA Slope	6	7	1	1	1	1	5	7	1	2	24	32
Shallow	16	11	0	1	0	1	4	9	1	2	13	26
Total	100	100	2	2	1	2	10	13	2	3	8	12
Rock Sole												
AI Deep	3	1	1	3	1	3	7	16	4	11	16	32
AI Shallow	6	3	1	1	1	1	7	10	4	6	17	22
BS Mud	4	1	0	0	0	0	1	0	0	0	0	0
BS Sand	**28**	**37**	**1**	**1**	**1**	**1**	**6**	**6**	**1**	**1**	**0**	**0**
BS Sand/Mud	**37**	**41**	**2**	**3**	**2**	**2**	**13**	**15**	**2**	**2**	**0**	**0**
BS Slope	2	1	3	2	2	1	11	9	3	2	0	0
GOA Deep Shelf	6	3	1	3	1	2	9	14	2	3	27	38
GOA Slope	1	0	1	1	1	1	8	8	2	2	41	45
GOA Shallow	13	13	0	1	0	1	5	6	1	2	14	17
Total	100	100	1	2	1	1	8	10	2	2	5	4
Flathead Sole												
AI Deep	1	1	2	3	2	3	10	12	7	8	18	19
AI Shallow	2	1	1	1	1	2	10	10	6	6	21	19
BS Mud	12	7	0	0	0	0	0	1	0	0	0	0
BS Sand	16	16	1	2	1	2	9	12	1	1	0	0
BS Sand/Mud	**35**	**41**	**2**	**3**	**2**	**2**	**13**	**15**	**2**	**2**	**0**	**0**
BS Slope	3	4	2	3	2	2	10	11	3	3	0	0
GOA Deep Shelf	15	15	1	1	1	1	5	6	1	1	17	19
GOA Slope	2	1	1	2	1	2	9	10	2	3	39	40
GOA Shallow	15	14	0	0	0	0	4	5	1	1	12	14
Total	100	100	1	2	1	2	8	10	1	2	5	6

Table B.3-3. LEIs (percent reduction) of Habitat Features within Intersections of Species Distributions and Habitat Types (cont.)

			Percent Reduction (General Distribution [95%]/Concentration [75%])									
	% of Area		Infauna Prey		Epifauna Prey		Living Structure		Non-living Structure		Hard Coral	
Habitat	**(95%)**	**(75%)**	**(95%)**	**(75%)**	**(95%)**	**(75%)**	**(95%)**	**(75%)**	**(95%)**	**(75%)**	**(95%)**	**(75%)**
Alaska Plaice												
AI Deep	0	0	18	17	20	18	64	57	48	43	86	77
AI Shallow	0	0	12	10	13	11	46	39	33	27	53	45
BS Mud	5	5	0	0	0	0	0	0	0	0	0	0
BS Sand	**42**	**42**	**1**	**0**	**1**	**0**	**5**	**4**	**0**	**0**	**0**	**0**
BS Sand/Mud	**52**	**52**	**2**	**2**	**2**	**2**	**12**	**10**	**1**	**1**	**0**	**0**
BS Slope	1	1	2	0	1	0	7	2	2	1	0	0
GOA Deep Shelf	0	0	2	0	1	0	10	0	2	0	14	0
GOA Shallow	1	1	1	0	0	0	6	0	1	0	15	0
Total	100	100	1	1	1	1	9	7	1	1	0	0
Rex sole												
AI Deep	3	2	1	4	1	4	8	18	5	13	16	33
AI Shallow	2	2	2	4	2	4	16	25	10	16	32	44
BS Sand	7	6	6	18	5	16	31	61	5	15	0	0
BS Sand/Mud	**29**	**9**	**4**	**9**	**3**	**7**	**21**	**37**	**4**	**9**	**0**	**0**
BS Slope	**5**	**5**	**3**	**6**	**2**	**5**	**12**	**22**	**3**	**6**	**0**	**0**
GOA Deep Shelf	**34**	**51**	**1**	**1**	**1**	**1**	**5**	**8**	**1**	**1**	**17**	**31**
GOA Slope	9	14	1	1	1	1	6	9	1	2	28	39
GOA Shallow	11	10	1	1	1	1	8	12	2	3	24	34
Total	100	100	2	3	2	3	12	16	3	4	12	26
Dover Sole												
AI Deep	3	0	1	7	1	7	7	24	5	18	13	32
AI Shallow	1	0	1	5	2	6	13	36	7	23	25	54
BS Sand	2	1	17	10	14	9	70	72	14	6	0	0
BS Sand/Mud	1	0	11	13	9	11	49	55	10	13	0	0
BS Slope	0	0	17	0	14	0	47	0	19	0	0	0
GOA Deep Shelf	**57**	**58**	**1**	**1**	**1**	**1**	**5**	**5**	**1**	**1**	**16**	**18**
GOA Slope	**17**	**19**	**1**	**1**	**1**	**1**	**5**	**5**	**1**	**1**	**22**	**22**
GOA Shallow	20	21	1	1	1	1	7	8	2	2	21	24
Total	100	100	1	1	1	1	7	7	2	1	17	20
Pacific Ocean perch												
AI Deep	**21**	**26**	**1**	**1**	**1**	**1**	**5**	**9**	**3**	**5**	**12**	**21**
AI Shallow	10	13	1	1	2	2	13	17	8	10	28	38
BS Sand	2	2	12	3	10	3	32	15	15	6	0	0
BS Sand/Mud	5	4	2	1	1	1	9	6	2	1	0	0
BS Slope	6	7	3	2	2	1	12	7	4	2	0	0
GOA Deep Shelf	**32**	**30**	**1**	**1**	**1**	**1**	**7**	**10**	**1**	**1**	**29**	**46**
GOA Slope	16	16	1	1	1	1	6	9	1	2	27	43
GOA Shallow	8	2	1	0	1	0	5	3	1	1	20	17
Total	100	100	1	1	1	1	8	10	3	4	20	31

Table B.3-3. LEIs (percent reduction) of Habitat Features within Intersections of Species Distributions and Habitat Types (cont.)

			Percent Reduction (General Distribution [95%]/Concentration [75%])									
	% of Area		Infauna Prey		Epifauna Prey		Living Structure		Non-living Structure		Hard Coral	
Habitat	**(95%)**	**(75%)**	**(95%)**	**(75%)**	**(95%)**	**(75%)**	**(95%)**	**(75%)**	**(95%)**	**(75%)**	**(95%)**	**(75%)**
Shortraker & Rougheye Rockfish												
AI Deep	**22**	**36**	**0**	**0**	**0**	**1**	**3**	**5**	**2**	**3**	**8**	**13**
AI Shallow	16	12	1	1	1	2	7	12	4	7	17	27
BS Sand	1	0	20	5	17	4	40	16	24	8	0	0
BS Sand/Mud	1	0	1	1	1	1	6	5	1	1	0	0
BS Slope	5	2	3	3	2	3	11	13	3	4	0	0
GOA Deep Shelf	**33**	**14**	**1**	**1**	**1**	**1**	**5**	**7**	**1**	**1**	**17**	**37**
GOA Slope	**16**	**34**	**1**	**1**	**1**	**1**	**5**	**6**	**1**	**2**	**21**	**30**
GOA Shallow	6	1	1	0	1	0	6	5	1	1	16	28
Total	100	100	1	1	1	1	6	7	2	3	15	24
Northern Rockfish												
AI Deep	19	17	1	1	1	2	6	13	4	8	16	28
AI Shallow	**27**	**21**	**1**	**1**	**1**	**2**	**8**	**16**	**5**	**10**	**19**	**34**
BS Sand	3	1	5	1	4	1	24	20	6	2	0	0
BS Sand/Mud	3	1	3	0	3	0	15	3	4	0	0	0
BS Slope	2	0	3	2	2	2	12	10	4	3	0	0
GOA Deep Shelf	**26**	**37**	**2**	**1**	**1**	**1**	**10**	**10**	**1**	**1**	**41**	**42**
GOA Slope	8	10	2	2	1	1	10	9	2	2	43	43
GOA Shallow	13	13	0	0	1	0	6	5	1	1	24	22
Total	100	100	1	1	1	1	9	11	3	4	25	35
Dusky Rockfish												
AI Deep	3	1	4	4	6	6	26	39	18	26	45	63
AI Shallow	3	1	4	3	6	4	35	31	23	20	61	55
BS Sand	3	0	22	0	19	0	66	0	15	0	0	0
BS Sand/Mud	1	0	6	0	5	0	23	0	7	0	0	0
BS Slope	0	0	2	0	2	0	12	0	3	0	0	0
GOA Deep Shelf	**57**	**69**	**1**	**1**	**1**	**1**	**8**	**10**	**1**	**1**	**31**	**46**
GOA Slope	14	19	1	1	1	1	8	10	2	2	38	45
GOA Shallow	20	11	1	1	1	1	7	8	2	2	25	38
Total	100	100	2	1	2	1	11	10	3	2	31	45
Thornyheads												
AI Deep	**27**	**23**	**0**	**0**	**0**	**1**	**3**	**4**	**2**	**2**	**7**	**9**
AI Shallow	7	5	1	1	1	2	11	12	6	7	24	27
BS Sand	1	1	20	17	17	14	42	38	22	20	0	0
BS Sand/Mud	2	1	1	1	1	1	7	7	1	1	0	0
BS Slope	10	12	2	2	2	1	8	8	2	2	0	0
GOA Deep Shelf	**30**	**33**	**1**	**1**	**1**	**1**	**5**	**4**	**1**	**1**	**20**	**18**
GOA Slope	**19**	**22**	**1**	**1**	**1**	**1**	**4**	**5**	**1**	**1**	**21**	**23**
GOA Shallow	4	2	0	0	0	0	4	2	1	1	15	14
Total	100	100	1	1	1	1	6	5	2	2	14	15

Note: Data include the percent of each species' distribution within each habitat type (habitat types containing 25% or more of either general or concentration areas are in bold face).

Table B.3-4. Stock Assessment Model Estimates of Age 3+ Biomass, Female Spawning Biomass, and Age 3 Recruits

Year	Age 3+ Biomass	Female Spawning Biomass	Age 3 Recruits (1,000's)
1984	166,843	54,537	18,397
1985	167,311	55,901	14,822
1986	167,913	57,398	19,075
1987	167,325	59,030	14,397
1988	165,770	60,705	10,799
1989	162,382	61,750	9,260
1990	158,001	62,307	9,089
1991	152,440	62,050	9,202
1992	139,092	57,560	6,129
1993	127,531	53,550	7,222
1994	121,276	51,798	11,378
1995	115,174	50,262	6,149
1996	111,096	49,023	11,634
1997	108,293	47,482	19,048
1998	104,501	44,912	17,378
1999	102,188	43,024	12,223
2000	100,747	40,997	16,046
2001	100,262	39,696	12,610
2002	100,837	38,685	15,823
2003	101,611	37,792	16,803
2004	101,991	36,898	15,406

Table B.4-1. Ratings of the Effects of Fishing on Essential Fish Habitat by Species and Life-history Process

Life -History Process	*Salmon Species*	*Weathervane Scallops*	*Red King Crab*	*Blue King Crab*	*Golden King Crab*	*Scarlet King Crab*	*Tanner Crab*	*Snow Crab*	*Deepwater Tanner Crab*
Spawning/Breeding	MT	MT	MT	MT	MT	MT	MT	U	MT
Feeding	MT	U	U	U	U	U	MT	MT	U
Growth to Maturity	MT	MT	MT	MT	U	U	MT	MT	U

Life -History Process	*Walleye Pollock*	*Pacific Cod*	*Sablefish*	*Atka Mackerel*	*Yellowfin Sole (BSAI)*	*Greenland Turbot (BSAI)*	*Arrowtooth Flounder*	*Rock Sole (BSAI)*	*Flathead Sole*	*Rex Sole (GOA)*	*Alaska Plaice (BSAI)*	*Shallow Water Flatfish (GOA)*	*Deep Water Flatfish (GOA)*	*Pacific Ocean Perch (BSAI)*	*Pacific Ocean Perch (GOA)*	*Shortraker/Rougheye Rockfish (BSAI)*	*Shortraker/Rougheye Rockfish (GOA)*	*Northern Rockfish (BSAI)*	*Northern Rockfish (GOA)*	*Pelagic Shelf Rockfish (GOA)*	*Shortspine Thornyheads (GOA)*	*Dusky Rockfish*	*Shortspine Thornyheads (BSAI)*
Spawning/Breeding	MT	MT	MT	MT	MT	MT	MT	MT	MT	MT	MT	U	U	MT	U	MT	U	MT	MT	MT	MT	U	MT
Feeding	MT	MT	U	MT	MT	MT	MT	MT	MT	MT	MT	U	U	MT	MT	MT	MT	MT	MT	MT	MT	MT	MT
Growth to Maturity	MT	MT	U	MT	MT	MT	MT	MT	MT	MT	MT	U	U	U	U	U	U	U	U	U	MT	U	MT

Life -History Process	*Sharks*	*Skates*	*Sculpins*	*Squids*	*Octopi*	*Osmeridae*	*Myctophidae*	*Ammodytidae*	*Trichodontidae*	*Pholidae*	*Stichaeidae*	*Gonostomatidae*	*Euphausiacea*
Spawning/Breeding	U	U	U	U	U	MT	MT	MT	MT	MT	MT	MT	MT
Feeding	U	U	U	U	U	MT	MT	MT	U	MT	MT	MT	MT
Growth to Maturity	U	U	U	U	U	MT	MT	MT	U	MT	MT	MT	MT

Rating codes: MMNT - More than Minimal and Not TemporaryA - Adverse, MT - Minimal, Temporary or None, B - Beneficial, U - Unknown effect

Table B.4-2. Summary of the Effects of Status Quo Fishing Activities on EFH for Managed Species[1]

Area	Species	Overall Evaluation	Comments/Concerns
Alaska	Salmon	MT	Habitat types used by salmon species are not substantially affected by fishing.
Alaska	Weathervane Scallops	MT/U	This species does not depend upon any habitat feature vulnerable to groundfish fishing activities. Based on the overlap of fisheries with juvenile and adult scallop stock distribution, there appear to be minimal effects on the weathervane scallop habitat.
Alaska	Red King Crab	MT/U	Fishing activities are considered to have overall minimal and temporary effects on EFH for red king crab. Non-habitat related direct mortality due to historical trawl bycatch may have been a factor in red king crab declines; however, this mortality has been mitigated by establishment of trawl closure areas.
Alaska	Blue King Crab	MT/U	Although both the Pribilof Islands stock and St. Matthew stock of blue king crabs are considered to be below MSST, habitat loss or degradation by fishing activities is not thought to have played any role in the decline of these stocks.
Alaska	Golden King Crab	MT/U	Fishing activities are considered to have overall minimal and temporary effects on the EFH of golden king crab. Groundfish trawl fishing in the Bering Sea slope is of some concern; however, any effects are thought to be minimal.
Alaska	Scarlet King	MT/U	This is a deepwater species with almost no overlap with commercial fisheries, so habitat effects are unlikely.
Alaska	Tanner Crab	MT	Fishing activities are considered to have overall minimal and temporary effects on EFH for Tanner crabs.
Alaska	Snow Crab	MT	Fishing effects on EFH are considered to have overall minimal and temporary effects on the EFH for snow crabs.
Alaska	Deepwater Tanner Crabs	MT/U	These are deepwater species with almost no overlap with commercial fisheries, so habitat effects are unlikely.
BSAI	Walleye Pollock	MT	Low association with benthic habitats. Pollock eggs, older juveniles, and adults are not primarily associated with benthic habitats.
BSAI GOA	Pacific cod	MT	Effects of fishing on habitat are insufficient to impair the ability of the BSAI or GOA Pacific cod stocks to sustain themselves at or near the MSY level.

Table B.4-2. Summary of the Effects of Status Quo Fishing Activities on EFH for Managed Species[1] (continued)

Area	Species	Overall Evaluation	Comments/Concerns
BSAI GOA	Sablefish	U	The estimated productivity and sustainable yield of sablefish has declined steadily since the late 1970's. This is demonstrated by a decreasing trend in recruitment and subsequent estimates of biomass reference points and the inability of the stock to rebuild to target biomass levels inspite of the decreasing level of the targets and fishing rates below the target fishing rate. While years of strong young of the year survival has occurred in the 1980-90's, the failure of strong recruitment to the mature stage suggests a decreased survival of juveniles during their residence as 2-4 year olds on the continental shelf. While climate related changes are a possible cause for reduced productivity, a variety of observations noted above are consistent with possible effects of fishing on habitat and resulting changes in the juvenile ecology of sablefish, possibly through increased competition for food and space. Given concern for the decline in the sustainable yield of sablefish, the possibility of the role of fishing effects on juvenile sablefish habitat, and the need for a better understanding of the possible causes, a MT rating is not merited and sablefish growth to maturity and feeding is rated UNKNOWN.
BSAI GOA	Atka Mackerel	MT	There is no evidence that the cumulative effects of fishing activities on habitat have impaired the stock's ability to produce MSY since 1977. Spawning stock biomass is at a peak level, the stock has produced several years of above average recruitment since 1977, and recent recruitment has been strong. Nor is there evidence to suggest that habitat disturbance has adversely impacted the spawning/breeding, growth to maturity, and feeding success of Atka mackerel. Therefore, the overall impact of habitat disturbance on Atka mackerel is minimal and temporary.
BSAI	Yellowfin Sole	MT	The yellowfin sole stock is currently at a high level of abundance, and well above BMSY. The effects of the reductions in habitat features are either minimal or temporary relative to spawning, adult feeding, juvenile survival and growth to maturity.
BSAI	Greenland Turbot	MT	The Greenland turbot stock is currently at a level of abundance above the BMSY level. The effects of the reductions in habitat features are either minimal or temporary relative to spawning, adult feeding, juvenile survival and growth to maturity.

Table B.4-2. Summary of the Effects of Status Quo Fishing Activities on EFH for Managed Species[1] (continued)

Area	Species	Overall Evaluation	Comments/Concerns
BSAI GOA	Arrowtooth Flounder	MT	The arrowtooth flounder stock is currently at a high level of abundance is both sea areas, well above the estimated BMSY level. The effects of the reductions in habitat features are either minimal or temporary relative to spawning, adult feeding, juvenile survival and growth to maturity.
BSAI	Rock Sole	MT	The rock sole stock is currently at a high level of abundance, and well above BMSY. The effects of the reductions in habitat features are either minimal or temporary relative to spawning, adult feeding, juvenile survival and growth to maturity.
BSAI	Flathead Sole	MT	The flathead sole stock is currently at a high level of abundance, and well above BMSY. The effects of the reductions in habitat features are either minimal or temporary relative to spawning, adult feeding, juvenile survival and growth to maturity.
GOA	Flathead Sole	MT	The flathead sole stock is currently at a high level of abundance, and well above BMSY. The effects of the reductions in habitat features are either minimal or temporary relative to spawning, adult feeding, juvenile survival and growth to maturity.
GOA	Rex Sole	U	The rex sole stock is currently at a high level of abundance, and well above BMSY. The effects of the reductions in habitat features are either minimal or temporary relative to spawning, adult feeding, juvenile survival and growth to maturity.
BSAI	Alaska Plaice	MT	The rex sole stock is currently at a high level of abundance, and well above BMSY. The effects of the reductions in habitat features are either minimal or temporary relative to spawning, adult feeding, juvenile survival and growth to maturity.
GOA	Shallow Water Flatfish	U	The level of information available for the eight species of this complex are insufficient to estimate the stock size relative to BMSY. It is unknown what the effects of the reductions in habitat features are relative to spawning, adult feeding, juvenile survival and growth to maturity.
GOA	Deep Water Flatfish	U	With the exception of Dover sole, the level of information available for the three species of this complex are insufficient to estimate the stock size relative to BMSY. It is therefore unknown what the effects of the reductions in habitat features are relative to spawning, adult feeding, juvenile survival and growth to maturity for these species in aggregate.

Table B.4-2. Summary of the Effects of Status Quo Fishing Activities on EFH for Managed Species[1] (continued)

Area	Species	Overall Evaluation	Comments/Concerns
BSAI	Pacific Ocean Perch	MT/U	The effects of fishing on the habitat of BSAI Pacific ocean perch are rated as either unknown or minimal and temporary. There is little information to suggest that these habitat reductions would affect spawning/breeding or feeding in a manner that is more than minimal or temporary, although much is unknown about these processes. Regarding growth to maturity, the LEI percentages do not exceed 13% for the living and non-living substrates, although these figures should be interpreted as rough guidelines that are estimated with some error and relate to entire BSAI stock. Examination of LEI maps indicate that finer scale impacts do occur and could be important for stocks such as POP which are thought to show population structure on small spatial scales.
GOA	Pacific Ocean perch	MT/U	The effects of fishing on the habitat of Pacific ocean perch are either unknown or negligible. The LEI analysis suggests that bottom trawling may have a negative impact on benthic habitats, especially sponges and hard corals. If a strong association exists between these substrates and Pacific ocean perch during any life stage, then there should be concern regarding the effects of fishing on the habitat. There is some evidence of these linkages, but habitat usage by Pacific ocean perch at different life stages is mostly unknown. Current stock status trends show no indications of fishing impacting the ability of the stock to maintain MSY.
BSAI	Shortraker and Rougheye rockfish	MT/U	The effects of fishing on the habitat of BSAI rougheye and shortraker rockfish are rated as either unknown or minimal and temporary. There is little information to suggest that these habitat reductions would affect spawning/breeding or feeding in a manner that is more than minimal or temporary, although much is unknown for these processes. Regarding growth to maturity, juvenile red rockfish have been observed to use living and non-living structures, with one specific use being the ability to find refuge from predators. Although the LEI percentages do not exceed 7% for the living and non-living substrates, higher percent reductions have been estimated for hard corals and studies on habitat associations have indicated that rougheye rockfish are associated with hard corals. Examination of LEI maps indicate that finer scale impacts do occur, although the extent to which habitat impacts occur at smaller scales and the importance of these impacts to the overall BSAI population are unknown.

Table B.4-2. Summary of the Effects of Status Quo Fishing Activities on EFH for Managed Species[1] (continued)

Area	Species	Overall Evaluation	Comments/Concerns
GOA	Shortraker and Rougheye Rockfish	MT/U	There is not enough information available to determine whether the habitat impacts of fishing affect spawning or growth to maturity. However, the known association of shortraker and rougheye rockfish with corals raises concern that fishing could have a negative impact on the habitat of these fish. Fishing appears to have a negligible effect on feeding of shortraker and rougheye rockfish.
BSAI	Northern rockfish	MT/U	The effects of fishing on the habitat of BSAI northern rockfish are rated as either unknown or minimal and temporary. There is little information to suggest that these habitat reductions would affect spawning/breeding or feeding in a manner that is more than minimal or temporary, although much is unknown about these processes. Regarding growth to maturity, juvenile red rockfish have been observed to use living and non-living structures, with one specific use being the ability to find refuge from predators. Although the LEI percentages do not exceed 8% for the living and non-living substrates, these figures should be interpreted as rough guidelines that are estimated with some error and relate to entire BSAI stock. Examination of LEI maps indicate that finer scale impacts do occur, although the extent to which these finer scale impacts may be important for northern rockfish is dependent upon the spatial scale of their population structure, which is currently unknown.
GOA	Northern Rockfish	MT/U	Fishing probably has little or no effect on prey availability and spawning/breeding behavior of northern rockfish in the Gulf of Alaska. A reduction in living and non-living structure could plausibly jeopardize growth to maturity due to a reduction of refuge habitat for juvenile northern rockfish. However, habitat requirements for the various life stages are mostly unknown, consequently, the effects of fishing on growth to maturity are also unknown.
GOA	Pelagic Shelf Rockfish	MT/U	The effects of fishing on the habitat of dusky rockfish and the pelagic shelf rockfish assemblage are either unknown or negligible. The LEI analysis indicates that bottom trawling may have a negative impact on the benthic habitat of pelagic shelf rockfish, especially corals and sponges. If a strong association exists between these substrates and pelagic shelf rockfish of any life stage then there should be concern regarding the effects of fishing on the habitat.

Table B.4-2. Summary of the Effects of Status Quo Fishing Activities on EFH for Managed Species[1] (continued)

Area	Species	Overall Evaluation	Comments/Concerns
GOA	Thornyhead Rockfish	MT	Thornyhead juveniles and adults are associated with benthic habitats, specifically, on the deep shelf and slope in any type of non-living substrate, but they may prefer hard, non-living substrate according to limited studies in the eastern Gulf of Alaska.
BSAI	Other Rockfish	U	Studies conducted in the Bering Sea or Aleutian Islands are inconclusive as to whether fishing activities have an effect on the habitat (relative to spawning/breeding, feeding, and growth to maturity) of light dusky rockfish and BSAI thornyhead rockfish.
BSAI	Other Species	U	Because appropriate information is lacking for the "other species" (i.e., sharks, skates, sculpins, squids, and octopi), it is impossible to assess whether the fisheries, as they are currently conducted off Alaska, are affecting habitat that is essential to the welfare of the species in question in a way that is more than minimal and not temporary.
Alaska	Forage Species	MT/U	Most of the forage species (i.e., Osmeridae, Myctophidae, Ammodytidae, Trichodontidae, Pholidae, Stichaeidae, Gonostomatidae, and Euphausiacea) do not overlap with known areas of intensive fishing, and/or there is little evidence that survival depends habitat affected by fishing.

[1] Based on information contained in Appendix B, Section 3.3. Evaluation notation is as follows: MT = minimal, temporary, or no effect; U = unknown; MMNT = more than minimal and not temporary.