Appendix D

REPORT ON UPDATES MADE TO THE PRODUCTION OF ESSENTIAL FISH HABITAT SUITABILITY PROBABILITY MAPS

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for

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Table of Contents

Introduction

Project Overview

The EFH project was the first attempt to make the explicit link (on a coast-wide basis) between habitat characteristics, habitat usage by fish and the potential distribution of EFH. The scale of this task required the development of innovative software approaches to compile, collate and analyse detailed habitat data for the entire west coast.

The project focussed on the need to provide management alternatives in terms of the amount of habitat designated as EFH in the framework of a risk assessment. The project compiled and collated data and information from diverse sources from many different government agencies and public and private organisations.

The analysis of the NMFS survey data using GLMs and GAMs was completed under the project, and enabled these data to contribute towards the designation of EFH. However, despite the extent of the survey time series data it could only contribute to 17 of the 328 possible HSP profiles that arise from the Groundfish FMP to be completed. Since it is only possible to extract depth and latitude for recorded species from within the NMFS survey data all of the information on substrate preferences comes from the HUD, and none of the profiles could have been completed from just the survey data.

To augment survey information that did not adequately cover the spatial distribution of a particular species the project successfully used information from expert opinion to complete 9 additional depth/latitude profiles for adults of species that was mostly, but not completely covered by the survey data. Such cases arose when, for example, the abundance information 0-30 m was not known from the survey data or in the case for 5 adult lifestages profiles were completed using survey data from 0-1200 meters combined with HUD data to complete the profile to their maximum depth distribution beyond 1200m.

Information in the HUD was used to create depth/latitude profiles for an additional 137 species/lifestage combinations, including 49 (approximately 60% of the species contained in the FMP) adult lifestages for which no other data were available. A further 58 profiles were developed for juveniles, 19 for larvae and 11 for eggs. The HUD therefore provided the first systematic organisation of data on groundfish usage of marine substrate on the west coast and was instrumental in being able to complete HSP for the majority of species-lifestage combinations.

As a result of the involvement of the project in sourcing and collating data and information relevant to the EFH process the project has achieved an extremely detailed analysis of the type and extent of information available to describe and identify EFH and evaluate threats to marine habitats on the West Coast of the US. A data gaps analysis was undertaken and detailed recommendations were provided for further work that will further support the identification of EFH, the evaluation of impacts and approaches to mitigation of those impacts.

Background to the Second Technical Review Committee Meeting

During the first Technical Committee Review meeting of the EFH model a number of discrepancies were highlighted in the underlying habitat associations between fish and substrate such that the derived habitat suitability probabilities were incorrect. There were two related problems: the resolution of some of the substrate data made discrimination between habitat types difficult; and, the biological information associating a particular species' lifestage to habitat type required additional error-trapping review.

Additional geological data became available that would improve the resolution of habitat discrimination derived from the GIS. These improved data would also allow the development of more accurate habitat suitability probabilities. There was therefore a need to incorporate these new data within the model, which required a range of technical GIS inputs.

NMFS staff at the Science Center has since undertaken further review of their data in the Habitat Use Database (HUD) to correct species association errors with substrate and to update the database with new information. There was a related need to modify the EFH model to incorporate two additional habitat classes, develop new HSP profiles and, once undertaken, undertake final peer review of these modifications (at a second TRC), incorporating any final revisions.

This report details the changes made to the underlying data set, modifications required of the model and brief details of analysis performed. Notes and comments collated during the second TRC meeting are appended as a future reference document. Final HSP maps have been provided to NMFS under separate cover.

Habitat Use Database (HUD) updates

A number of updates and corrections to the HUD database had been performed by NMFS staff, since the first technical review committee meeting in Portland, to address the discrepancies between the recorded habitat associations in the HUD and the understanding of the TRC that reviewed the GIS maps. At that meeting it was decided that NMFS should verify the data in the HUD database due to concerns with data quality and consistency.

The NMFS reviewers reviewed all the habitat associations in the HUD and modified and updated recorded associations for most species/lifestage combination. Additionally two new "level 0" habitats; "inlandsea" and "nearshore" were also introduced. Because of the large number of undocumented changes made to the habitat associations in the HUD database, it was decided by the contractor to update all habitat associations in the Bayesian Network model from the updated HUD database and re-run all species/life stages to ensure that all the changes to the habitat association data had been captured in the model as well. This involved introducing the two new level 0 habitat associations.

Model Updates

It is important to state that there have not been any changes made to the original modeling concepts as previously described for the original EFH model. The Bayesian Network Model was updated to accommodate the two new habitat codes, "inlandsea" and "nearshore", where "inlandsea" was defined to be the Puget Sound area that previously was classified as estuary. This solved the issues that some species/life stages live in estuaries but not in the Puget Sound and vice versa. The "nearshore" code was used as a new parameter to identify those Californian species that lived only in near shore mainland coastal habitats but not in near shore habitats associated with offshore islands. The habitat associations were completely updated from the updated HUD database provided by NMFS.

GIS Updates

Updates to the geology data in Washington and Oregon were provided by Chris Romsos of the Active Tectonics and Seafloor Mapping Lab at Oregon State University. These updates included some additions of rocky habitat off the northern coast of Washington State. The version of the data used for this update was version 1.5. The changes incorporated in this version are described here: http://www.activetectonics.coas.oregonstate.edu/main_pages/Change_History.html. These new geology data were combined into the merged habitat data layers.

Due to the addition of new habitat types in the Habitat Use Database (HUD), some updates to the GIS data were required to correspond to these habitats. As mentioned above, because of the difference in the oceanographic conditions and the types of species that occur there, the description of Puget Sound was changed from an estuary to an inland sea. The polygons making up the waters of Puget Sound were selected and identified as an inland sea, rather than an estuary.

The other change to the HUD, as described above, was the addition of a "nearshore" category, intended to differentiate species that only occur close to the continent and do not occur in the same substrate, latitude, and depth environments around offshore islands, specifically the Channel Islands. Three species were affected by this change: Brown Rockfish, Calico Rockfish, and China Rockfish. Ideally, this modification would have been approached by addition of a parameter to the model and a GIS-based delineation of “nearshore” areas, such as distance from the continental shoreline. However, this modification occurred too late in the EIS process to use the preferred approach. Instead, the three species were modelled as usual, and then, within the GIS data, any polygons near the Channel Islands with an HSP value > 0 were manually selected and HSP was set to zero.

SECOND TECHNICAL REVIEW COMMITTEE MEETING

Upon completion of the updated maps the technical review committee met again in September 2005 to review the updated maps.

All 82 adult lifestage maps and a number of juvenile maps were reviewed by the TRC and the vast majority of these were approved by the committee (Annex 1 to this report captures the comments by lifestage from this meeting). Two of the 82 adult species (dusky and brown rock fish) were removed completely after it was determined that their ranges did not extend into the area covered by the FMP. There were 16 adult species in the HUD database that the committee still questioned the habitat associations for and these habitat associations were revised on the basis of additional expert opinion present at the TRC meeting. During and following the meeting the contractor further updated the habitat associations in the HUD database and in the Bayesian Network model for these 16 species and re-ran and re-created the maps for these in accordance with the advice given at the meeting.

Based on input from the review meeting in September 2005, the maps were also updated to provide additional information. Information about the data source(s) behind the model was added as annotation, and, where available, a photograph of the adult lifestage of the species was put the map. Photographs were provided by Waldo Wakefield and Julia Clemons of NMFS, Northwest Fisheries Science Center and from the RACE website of the Alaska Fisheries Science Center.

In concluding its work the Committee drafted a final statement (Annex 2) that captures elements of the process followed during the meeting, observations and caveats concerning how the HSP maps should be utilized and a series of recommendations (that includes the identification of critical gaps in the current information base) that need to be addressed to ensure that continued progress regarding the identification of EFH can be made.

ANNEX 1: NOTES AND COMMENTS RECORDED AT THE SECOND TECHNICAL REVIEW COMMITTEE MEETING CONCERNING THE APPROVAL OF THE HSP MAPS AND THE FURTHER CHANGES REQUIRED

	SpeciesSci	SpeciesCommon	Gender	Lifestage	Abs Min Depth	Pref Min Depth	Pref Max Depth	Abs Max Depth	Abs Min Lat	Pref Min Lat	Pref Max Lat	Abs Max Lat	Date type	Notes and comments from the Technical Review Committee
1	Squalus acanthias	Spiny dogfish	Both	Adults	0	0	350	1236	30			55	H	Like mud and sand, live in all substrata, like all bottom types; must be corrected in the HUD
1	Squalus acanthias	Spiny dogfish	Both	Juveniles		0	350		30			55	H	
2	Galeorhinus galeus	Soupfin shark	Both	Adults	2			471	26.7	37	39	60	H	Redo with these values(Done)
2	Galeorhinus galeus	Soupfin shark	Both	Juveniles	2			471	26.7	32.5	42	60	H	
3	Triakis semifasciata	Leopard shark	Both	Adults	0		4	91	23	32.5	42	43	H	Committee approved map
3	Triakis semifasciata	Leopard shark	Both	Juveniles	0		4	91	23	32.5	42	43	H	
4	Raja binoculata	Big skate	Both	Adults	3	50	200	800	30.5	34.5		55	H	Committee approved map
4	Raja binoculata	Big skate	Unknown	Eggs		50	200		30.5	34.5		55	H	
4	Raja binoculata	Big skate	Both	Juveniles		50	200		30.5	34.5		55	H	
5	Raja inornata	California skate	Both	Adults			18	1600	28	32.5		48.5	H	Committee approved map
5	Raja inornata	California skate	Unknown	Eggs	0	0	18	671	28	32.5	42	48.5	H	
5	Raja inornata	California skate	Both	Juveniles		0	18	671	28	32.5	42	48.5	H	
6	Raja rhina	Longnose skate	Both	Adults	0	100	150	1069	28			53.5	H	Committee approved map
6	Raja rhina	Longnose skate	Unknown	Eggs	55			622	28			53.5	H	
6	Raja rhina	Longnose skate	Both	Juveniles	55	100	150	622	28			53.5	H	
7	Hydrolagus colliei	Spotted ratfish	Both	Adults	0	100	150	971	28.5			58	H	Same problem as dogfish - HUD missing habitat association; Should appear equally on sand and mud(Done)
7	Hydrolagus colliei	Spotted ratfish	Unknown	Eggs		100	150	913	28.5			58	H	
7	Hydrolagus colliei	Spotted ratfish	Both	Juveniles	0	100	150	913	28.5			58	H	

	SpeciesSci	SpeciesCommon	Gender	Lifestage	Abs Min Depth	Pref Min Depth	Pref Max Depth	Abs Max Depth	Abs Min Lat	Pref Min Lat	Pref Max Lat	Abs Max Lat	Date type	Notes and comments from the Technical Review Committee
8	Citharichthys sordidus	Pacific sanddab	Both	Adults	0	50	150	549	22.8			55	SE	Should be more probable south of OR/CA border. Check survey/GAM
8	Citharichthys sordidus	Pacific sanddab	Unknown	Eggs					22.8			55		
8	Citharichthys sordidus	Pacific sanddab	Both	Juveniles					22.8			55		
8	Citharichthys sordidus	Pacific sanddab	Unknown	Larvae					22.8			55		
9	Atheresthes stomias	Arrowtooth flounder	Both	Adults	9	50	500	900	35.6	42.8	55	55	SE	Shouldn't appear on rocky habitats -- Check HUD Association(Done)
9	Atheresthes stomias	Arrowtooth flounder	Unknown	Eggs	0	0	200	3100	35.6			55	H	
9	Atheresthes stomias	Arrowtooth flounder	Both	Juveniles		50	500		35.6	42.8	55	55	H	
9	Atheresthes stomias	Arrowtooth flounder	Unknown	Larvae	0	0	200	3100	35.6			55	H	
10	Hippoglossoides elassodon	Flathead sole	Both	Adults	0	0	366	1050	37			55	SE	Committee approved map
10	Hippoglossoides elassodon	Flathead sole	Unknown	Eggs					38			55		
10	Hippoglossoides elassodon	Flathead sole	Both	Juveniles		40	100		38			55	H	
10	Hippoglossoides elassodon	Flathead sole	Unknown	Larvae					38			55		
11	Eopsetta jordani	Petrale sole	Both	Adults	0	50	300	550	30	38	49	60	SE	Winter distribution is not correct; should go out to 200 fm in winter
11	Eopsetta jordani	Petrale sole	Unknown	Eggs					30	38	49	60		
11	Eopsetta jordani	Petrale sole	Both	Juveniles		18	145		30	38	49	60	H	
11	Eopsetta jordani	Petrale sole	Unknown	Larvae					30	38	49	60		
12	Parophrys vetulus	English sole	Both	Adults	0	0	250	550	37.5			55	H	Committee approved map
12	Parophrys	English sole	Unknown	Eggs					37.5			55		

	SpeciesSci	SpeciesCommon	Gender	Lifestage	Abs Min Depth	Pref Min Depth	Pref Max Depth	Abs Max Depth	Abs Min Lat	Pref Min Lat	Pref Max Lat	Abs Max Lat	Date type	Notes and comments from the Technical Review Committee
	vetulus													
12	Parophrys vetulus	English sole	Both	Juveniles	0			150	37.5			55	H	
12	Parophrys vetulus	English sole	Unknown	Larvae				200	37.5			55	H	
13	Microstomus pacificus	Dover sole	Both	Adults	80	200	500	1200	27.5	34	48	55	S	HSP should be higher in shallower areas. Should see Dover in Canyons and Basins at appropriate depth, substrate and latitude. This is a HUD/GIS translation inconsistency (Done)
13	Microstomus pacificus	Dover sole	Unknown	Eggs					27.5			55		
13	Microstomus pacificus	Dover sole	Both	Juveniles	100	200	700	700	27.5	34	48	55	H	
13	Microstomus pacificus	Dover sole	Unknown	Larvae					27.5			55		
14	Glyptocephalus zachirus	Rex sole	Both	Adults	0	50	450	850	28			55	S	
14	Glyptocephalus zachirus	Rex sole	Unknown	Eggs					28			55		
14	Glyptocephalus zachirus	Rex sole	Both	Juveniles		150	200		28			55	H	
14	Glyptocephalus zachirus	Rex sole	Unknown	Larvae										
15	Platichthys stellatus	Starry flounder	Both	Adults	0	0	150	375	33.7			55	H	Depth shown is too deep. Should go out to 35 fm (Done)
15	Platichthys stellatus	Starry flounder	Unknown	Eggs		20	70		33.7			55	H	
15	Platichthys stellatus	Starry flounder	Both	Juveniles	0			100	33.7			55	H	
15	Platichthys stellatus	Starry flounder	Unknown	Larvae					33.7			55		

	SpeciesSci	SpeciesCommon	Gender	Lifestage	Abs Min Depth	Pref Min Depth	Pref Max Depth	Abs Max Depth	Abs Min Lat	Pref Min Lat	Pref Max Lat	Abs Max Lat	Date type	Notes and comments from the Technical Review Committee
16	Psettichthys melanostictus	Sand sole	Both	Adults	0	0	73	183	34			55	H	Max depth should be 73, preferred max depth 56(Done)
16	Psettichthys melanostictus	Sand sole	Unknown	Eggs					33			55		
16	Psettichthys melanostictus	Sand sole	Both	Juveniles	0	0	80	183	33			55	H	
16	Psettichthys melanostictus	Sand sole	Unknown	Larvae			200		33			55	H	
17	Lepidopsetta bilineata	Rock sole	Both	Adults	0	0	300	732	32			55	H	Same areas as rex sole. Committee approved map.
17	Lepidopsetta bilineata	Rock sole	Unknown	Eggs					32			55		
17	Lepidopsetta bilineata	Rock sole	Both	Juveniles					32			55		
17	Lepidopsetta bilineata	Rock sole	Unknown	Larvae					32			55		
18	Isopsetta isolepis	Butter sole	Both	Adults	0		150	425	34.3			55	H	Preferred max depth should be 60, Preferred min lat should be 42(Done)
18	Isopsetta isolepis	Butter sole	Unknown	Eggs					34.3			55		
18	Isopsetta isolepis	Butter sole	Both	Juveniles					34.3			55		
18	Isopsetta isolepis	Butter sole	Unknown	Larvae					34.3			55		
19	Pleuronichthys decurrens	Curlfin sole	Both	Adults	7	7	90	532	31			55	S	Committee approved map
19	Pleuronichthys decurrens	Curlfin sole	Unknown	Eggs					31			55		
19	Pleuronichthys decurrens	Curlfin sole	Both	Juveniles					31			55		
19	Pleuronichthys decurrens	Curlfin sole	Unknown	Larvae					31			55		

	SpeciesSci	SpeciesCommon	Gender	Lifestage	Abs Min Depth	Pref Min Depth	Pref Max Depth	Abs Max Depth	Abs Min Lat	Pref Min Lat	Pref Max Lat	Abs Max Lat	Date type	Notes and comments from the Technical Review Committee
20	Anoplopoma fimbria	Sablefish	Both	Adults	0	200	1200	1900	28			55	SH	Max depth for this species is unknown. Should be depth driven only (should appear in Basins -- HUD needs update). Check latitude at south end (Done)
20	Anoplopoma fimbria	Sablefish	Unknown	Eggs	0	300	1200	1900	28			55	H	
20	Anoplopoma fimbria	Sablefish	Both	Juveniles	0			1200	28			55	H	
20	Anoplopoma fimbria	Sablefish	Both	Larvae	0			1200	28			55	H	
21	Coryphaenoides acrolepis	Pacific rattail (grenadie)r	Both	Adults	155	1500		2825	30			55	SH	Committee approved map
21	Coryphaenoides acrolepis	Pacific rattail (grenadie)r	Unknown	Eggs		0	200		30			55	H	
21	Coryphaenoides acrolepis	Pacific rattail (grenadie)r	Both	Juveniles		500			30			55	H	
21	Coryphaenoides acrolepis	Pacific rattail (grenadie)r	Unknown	Larvae		0	200		30			50	H	
22	Scorpaenichthys marmoratus	Cabezon	Both	Adults	0		25	76	27			54	H	Committee approved map
22	Scorpaenichthys marmoratus	Cabezon	Unknown	Eggs	0				27			54		
22	Scorpaenichthys marmoratus	Cabezon	Both	Juveniles	0				27			54		
22	Scorpaenichthys marmoratus	Cabezon	Unknown	Larvae	0				27			54		
23	Gadus macrocephalus	Pacific cod	Both	Adults	40	50	300	875	34			55	S	Occurs on kelp and rocky (also in water column above these habitat types) Association for the water column should be rock (Done)
23	Gadus macrocephalus	Pacific cod	Unknown	Eggs		60		150	34			55	H	

	SpeciesSci	SpeciesCommon	Gender	Lifestage	Abs Min Depth	Pref Min Depth	Pref Max Depth	Abs Max Depth	Abs Min Lat	Pref Min Lat	Pref Max Lat	Abs Max Lat	Date type	Notes and comments from the Technical Review Committee
23	Gadus macrocephalus	Pacific cod	Both	Juveniles	0			875	34			55	H	
23	Gadus macrocephalus	Pacific cod	Unknown	Larvae	0	15	30	45	34			55	H	
24	Antimora microlepis	Pacific flatnose	Both	Adults	350	500	950	3050	23			55	SH	Committee approved map
25	Ophiodon elongatus	Lingcod	Both	Adults	0	100	150	475	32	34.5	58	58	S	Depth 0-150 fm, lat - full coast. According to fishermen, habitat association should include more than just rock. There is a difference of opinion between scientists and fishermen (Done)
25	Ophiodon elongatus	Lingcod	Unknown	Eggs		3	10		32	34.5	58	58	H	
25	Ophiodon elongatus	Lingcod	Both	Juveniles		0	150		32	34.5	58	58	H	Committee approved map
25	Ophiodon elongatus	Lingcod	Both	Larvae	0			150	32	34.5	58	58	H	
26	Hexagrammos decagrammus	Kelp greenling	Both	Adults	0		20	52	33	34.5	55	55	H	Highest association with nearshore rocks and reefs and kelps, preferred habitat. Absolute max depth should be 65 meters from submarine studies out of Newport(Done)
26	Hexagrammos decagrammus	Kelp greenling	Unknown	Eggs					33	34.5	55	55		
26	Hexagrammos decagrammus	Kelp greenling	Both	Juveniles					33	34.5	55	55		
26	Hexagrammos decagrammus	Kelp greenling	Unknown	Larvae	0			45	33	34.5	55	55	H	
27	Merluccius productus	Pacific hake	Both	Adults	0	50	500	920	24.5	24.5	50	54.5	H	Committee approved map. Habitat association for estuaries should be removed in HUD

	SpeciesSci	SpeciesCommon	Gender	Lifestage	Abs Min Depth	Pref Min Depth	Pref Max Depth	Abs Max Depth	Abs Min Lat	Pref Min Lat	Pref Max Lat	Abs Max Lat	Date type	Notes and comments from the Technical Review Committee
														(Waiting on Colin since name disappeared)
27	Merluccius productus	Pacific hake	Both	Eggs	40			150	24.5			36	H	
27	Merluccius productus	Pacific hake	Both	Juveniles	0			920	24.5	24.5	50	54.5	H	
27	Merluccius productus	Pacific hake	Both	Larvae	40			150	24.5			36	H	All habitat associations equals zero, i.e. no map.
28	Sebastolobus alascanus	Shortspine thornyhead	Both	Adults	20	100	850	1524	32			55	SH	Committee approved map. Sediment shelf should have higher association(Done)
28	Sebastolobus alascanus	Shortspine thornyhead	Unknown	Eggs		0	1		32			55		
28	Sebastolobus alascanus	Shortspine thornyhead	Both	Juveniles		100	600		32			55	H	
28	Sebastolobus alascanus	Shortspine thornyhead	Unknown	Larvae					32			55		
29	Sebastolobus altivelis	Longspine thornyhead	Both	Adults	400	500	1300	1755	23	33	55	55	SH	Committee approved map
29	Sebastolobus altivelis	Longspine thornyhead	Unknown	Eggs					23			55		
29	Sebastolobus altivelis	Longspine thornyhead	Both	Juveniles	500	600	1200	1300	23			55	H	
29	Sebastolobus altivelis	Longspine thornyhead	Unknown	Larvae					23			55		
30	Sebastes umbrosus	Honeycomb rockfish	Both	Adults	30	45	60	270	26.05	27	34.5	36.6	H	Committee approved map
30	Sebastes umbrosus	Honeycomb rockfish	Both	Juveniles	27			54	26.05	27	34.5	36.6	H	
31	Sebastes aleutianus	Rougheye rockfish	Both	Adults	25	50	450	875	32.5			55	S	Committee approved map
31	Sebastes aleutianus	Rougheye rockfish	Both	Juveniles	25			875	32.5			55	H	
32	Sebastes alutus	Pacific ocean perch	Both	Adults	25	100	450	825	32.8			55	S	

	SpeciesSci	SpeciesCommon	Gender	Lifestage	Abs Min Depth	Pref Min Depth	Pref Max Depth	Abs Max Depth	Abs Min Lat	Pref Min Lat	Pref Max Lat	Abs Max Lat	Date type	Notes and comments from the Technical Review Committee
32	Sebastes alutus	Pacific ocean perch	Both	Juveniles	25	37		825	32.8			55	H	
32	Sebastes alutus	Pacific ocean perch	Unknown	Larvae		215	400		32.8			55	H	
33	Sebastes atrovirens	Kelp rockfish	Both	Adults	3	18	24	58	27.2	32	38	39	H	Committee approved map
33	Sebastes atrovirens	Kelp rockfish	Both	Juveniles					27.2			39		
33	Sebastes atrovirens	Kelp rockfish	Unknown	Larvae					27.2			38.3		
34	Sebastes auriculatus	Brown rockfish	Both	Adults	0	1	120	135	23	23	38	54	Remove	Does occur in sand, update habitat association. Take this species out.
34	Sebastes auriculatus	Brown rockfish	Both	Juveniles		50	90		23	23	38	54	Remove	
34	Sebastes auriculatus	Brown rockfish	Unknown	Larvae					23	23	38	54	Remove	
35	Sebastes aurora	Aurora rockfish	Both	Adults	81	300	500	893	28			49	S	Committee approved map
35	Sebastes aurora	Aurora rockfish	Both	Juveniles	81	300	500	893	28			49	H	
35	Sebastes aurora	Aurora rockfish	Unknown	Larvae				2000	32.5			49	H	
36	Sebastes brevispinis	Silvergray rockfish	Both	Adults	0	100	300	436	33.5			55	S	Committee approved map
36	Sebastes brevispinis	Silvergray rockfish	Both	Juveniles					33.5			55		
36	Sebastes brevispinis	Silvergray rockfish	Unknown	Larvae					33.5			55		
37	Sebastes carnatus	Gopher rockfish	Both	Adults	0	12	37	86	28	32.5	39.5	42.8	H	Rerun, does not appear in sand. Correct habitat association (Done)
37	Sebastes carnatus	Gopher rockfish	Both	Juveniles	0	12	37	80	28	32.5	39.5	42.8	H	
37	Sebastes carnatus	Gopher rockfish	Unknown	Larvae	0			80	28	32.5	39.5	42.8	H	
38	Sebastes caurinus	Copper rockfish	Both	Adults	0		90	183	28	32	34.5	61	H	

	SpeciesSci	SpeciesCommon	Gender	Lifestage	Abs Min Depth	Pref Min Depth	Pref Max Depth	Abs Max Depth	Abs Min Lat	Pref Min Lat	Pref Max Lat	Abs Max Lat	Date type	Notes and comments from the Technical Review Committee
38	Sebastes caurinus	Copper rockfish	Both	Juveniles	0				28	32	34.5	61		
38	Sebastes caurinus	Copper rockfish	Unknown	Larvae					28			59		
39	Sebastes chlorostictus	Greenspotted rockfish	Both	Adults	90	90	179	209	28	28	36.7	47.1	S	Committee approved map
39	Sebastes chlorostictus	Greenspotted rockfish	Both	Juveniles		30	89		28	28	36.7	47.1	H	
39	Sebastes chlorostictus	Greenspotted rockfish	Unknown	Larvae					28			47.1		
40	Sebastes variabilis	Dusky rockfish	Both	Adults	10	100	300	675	44	54	60	60	Remove	Remove Dusky from HUD as it does not occur on the West coast
41	Sebastes chrysomelas	Black-and-yellow rockfish	Both	Adults	0	1	18	37	28	34.5	39.5	42.8	H	Depth figure appears to be too deep. Does not appear on sand and rock; check habitat database (Done)
41	Sebastes chrysomelas	Black-and-yellow rockfish	Both	Juveniles	0	1	18	37	28	34.5	39.5	42.8	H	
41	Sebastes chrysomelas	Black-and-yellow rockfish	Unknown	Larvae	0			37	28	32.5	39.5	42.8	H	
42	Sebastes constellatus	Starry rockfish	Both	Adults	24	60	150	274	23	23	36.5	37.5	H	Change absolute max to 38 (Done). Only found on rock, not on sand - check HUD. (Done)
42	Sebastes constellatus	Starry rockfish	Both	Juveniles		30	120		23			37.5	H	
42	Sebastes constellatus	Starry rockfish	Unknown	Larvae					23			37.5		
43	Sebastes crameri	Darkblotched rockfish	Both	Adults	25	140	210	910	33.3			60	S	Committee approved map
43	Sebastes crameri	Darkblotched rockfish	Both	Juveniles		55	200		33.3			60	H	
43	Sebastes crameri	Darkblotched rockfish	Unknown	Larvae	55	90		1300	33.3			55	H	

	SpeciesSci	SpeciesCommon	Gender	Lifestage	Abs Min Depth	Pref Min Depth	Pref Max Depth	Abs Max Depth	Abs Min Lat	Pref Min Lat	Pref Max Lat	Abs Max Lat	Date type	Notes and comments from the Technical Review Committee
44	Sebastes dalli	Calico rockfish	Both	Adults	18	60	120	256	27.8			37.6	H	Committee approved map
44	Sebastes dalli	Calico rockfish	Both	Juveniles		20	42		27.8			37.6	H	
44	Sebastes dalli	Calico rockfish	Unknown	Larvae					27.8			37.6		
45	Sebastes diploproa	Splitnose rockfish	Both	Adults	80	150	450	800	28			60.5	S	Committee approved map
45	Sebastes diploproa	Splitnose rockfish	Both	Juveniles	0	91	272	800	28			60.5	H	
45	Sebastes diploproa	Splitnose rockfish	Unknown	Larvae	0			2000	28			60.5	H	
46	Sebastes elongatus	Greenstriped rockfish	Both	Adults	52	100	250	828	28	31	54	55	S	Check profile for latitude. Higher values are expected off California. (Done)
46	Sebastes elongatus	Greenstriped rockfish	Both	Juveniles		60	100		28	31	54	55	H	
46	Sebastes elongatus	Greenstriped rockfish	Unknown	Larvae					28			55		
47	Sebastes entomelas	Widow rockfish	Both	Adults	24	100	350	549	31.8	38	54	56.5	H	Hud data; 47-47.5 Rock should be brown; this species is underrepresented in the survey (Done)
47	Sebastes entomelas	Widow rockfish	Both	Juveniles	10	10		140	31.8	38	54	56.5	H	
47	Sebastes entomelas	Widow rockfish	Unknown	Larvae					31.8			56.5		
48	Sebastes eos	Pink rockfish	Both	Adults	76			366	27.8			38	H	(absminlat 25 absmaxlat 44 preferedmaxlat38 preminlat 27.8) Should only appear on Rocks (Done)
48	Sebastes eos	Pink rockfish	Both	Juveniles					27.8			38		
49	Sebastes flavidus	Yellowtail rockfish	Both	Adults	0	90	180	549	32.7	42	48	55	H	Not showing up outside Tillamook, baldi reef.not mapped. Also associated with dropoff features

	SpeciesSci	SpeciesCommon	Gender	Lifestage	Abs Min Depth	Pref Min Depth	Pref Max Depth	Abs Max Depth	Abs Min Lat	Pref Min Lat	Pref Max Lat	Abs Max Lat	Date type	Notes and comments from the Technical Review Committee
														edges, steep canyon. Not enough detail in map
49	Sebastes flavidus	Yellowtail rockfish	Both	Juveniles		20	37		32.7	42	48	55	H	
49	Sebastes flavidus	Yellowtail rockfish	Unknown	Larvae					32.7			55		Should be dark on the edges of the contour line going into Puget sounds
50	Sebastes gilli	Bronzespotted rockfish	Both	Adults	75	200	290	413	31			41	H	Committee approved map
50	Sebastes gilli	Bronzespotted rockfish	Both	Juveniles	75	200	290	413	31			41	H	
51	Sebastes goodei	Chilipepper	Both	Adults	0	50	250	425	24.5	32.5	39.3	51	SE	Committee approved map
51	Sebastes goodei	Chilipepper	Both	Juveniles	0	30	50	50	24.5	32.5	39.3	51	H	
51	Sebastes goodei	Chilipepper	Unknown	Larvae					24.5			50.7		
52	Sebastes helvomaculatus	Rosethorn rockfish	Both	Adults	25	100	350	550	28.5			55	S	
52	Sebastes helvomaculatus	Rosethorn rockfish	Both	Juveniles					28.5			55		
52	Sebastes helvomaculatus	Rosethorn rockfish	Unknown	Larvae					28.5			55		
53	Sebastes hopkinsi	Squarespot rockfish	Both	Adults	18	36	150	224	28	30	38	42	H	Committee approved map. Only on rock(Done)
53	Sebastes hopkinsi	Squarespot rockfish	Both	Juveniles	27	27	46		28	30	38	42	H	
53	Sebastes hopkinsi	Squarespot rockfish	Unknown	Larvae					28			42		
54	Sebastes jordani	Shortbelly rockfish	Both	Adults	50	150	200	350	28.3			48.5	SE	Committee approved map
54	Sebastes jordani	Shortbelly rockfish	Both	Juveniles					28.3			48.5		
54	Sebastes jordani	Shortbelly rockfish	Unknown	Larvae					28.3			48.5		
55	Sebastes levis	Cowcod	Both	Adults	40	150	244	491	28.5	32.5	34.5	44.5	H	Use the HUD kill at 40.5 latitude(Done)
55	Sebastes levis	Cowcod	Both	Juveniles		40	224		28.5	32.5	34.5	44.5	H	
55	Sebastes levis	Cowcod	Unknown	Larvae					28.5			39.3		

	SpeciesSci	SpeciesCommon	Gender	Lifestage	Abs Min Depth	Pref Min Depth	Pref Max Depth	Abs Max Depth	Abs Min Lat	Pref Min Lat	Pref Max Lat	Abs Max Lat	Date type	Notes and comments from the Technical Review Committee
56	Sebastes macdonaldi	Mexican rockfish	Both	Adults	76			256	22.5			36.3	H	Most abundant 28, preferred max lat 34, rock bottom(Done)
56	Sebastes macdonaldi	Mexican rockfish	Both	Juveniles		80	100		22.5			36.3	H	
56	Sebastes macdonaldi	Mexican rockfish	Unknown	Larvae		80	100		22.5			36.3	H	
57	Sebastes maliger	Quillback rockfish	Both	Adults	3	9	147	275	34			55	H	Committee approved map
57	Sebastes maliger	Quillback rockfish	Both	Juveniles	0	0	60		34			55	H	
57	Sebastes maliger	Quillback rockfish	Unknown	Larvae					34			55		
58	Sebastes melanops	Black rockfish	Both	Adults	0	0	55	366	34	38	54	55	H	
58	Sebastes melanops	Black rockfish	Both	Juveniles	0	0	20	20	34	38	54	55	H	
58	Sebastes melanops	Black rockfish	Unknown	Larvae					34	38	54	55		
59	Sebastes melanostomus	Blackgill rockfish	Both	Adults	125	250	600	768	36.7			46.5	H	Wrong in HUD, should extend to the Mexican border from the Canadian border (Preferred limits are 32-40) (Done)
59	Sebastes melanostomus	Blackgill rockfish	Both	Juveniles	125	180		768	36.7			46.5	H	
59	Sebastes melanostomus	Blackgill rockfish	Unknown	Larvae			100	768	36.7			46.5	H	
60	Sebastes miniatus	Vermilion rockfish	Both	Adults	15	50	150	436	28			60	H	Rerun preferred max lat 39. Habitat association is rock high, sand low, mud medium(Done)
60	Sebastes miniatus	Vermilion rockfish	Both	Juveniles					28			60		
60	Sebastes miniatus	Vermilion rockfish	Unknown	Larvae					28			37.5		

	SpeciesSci	SpeciesCommon	Gender	Lifestage	Abs Min Depth	Pref Min Depth	Pref Max Depth	Abs Max Depth	Abs Min Lat	Pref Min Lat	Pref Max Lat	Abs Max Lat	Date type	Notes and comments from the Technical Review Committee
61	Sebastes mystinus	Blue rockfish	Both	Adults	0	25	90	550	31.5	33	46.5	55	H	Committee approved map
61	Sebastes mystinus	Blue rockfish	Both	Juveniles	0	6	40	100	31.5	33	46.5	55	H	
61	Sebastes mystinus	Blue rockfish	Unknown	Larvae	0			100	31.5	32	50	55	H	
62	Sebastes nebulosus	China rockfish	Both	Adults	3	18	92	128	33.3	36	59.5	59.5	H	Committee approved map
62	Sebastes nebulosus	China rockfish	Both	Juveniles	0	8	18		33.3	36	59.5	59.5	H	
62	Sebastes nebulosus	China rockfish	Unknown	Larvae					33.3	36	59.5	59.5		
63	Sebastes nigrocinctus	Tiger rockfish	Both	Adults	3	55	274	274	32.5	41	55	60	H	Committee approved map
63	Sebastes nigrocinctus	Tiger rockfish	Both	Juveniles					32.5	41	55	60		
63	Sebastes nigrocinctus	Tiger rockfish	Unknown	Larvae					35.2			60		
64	Sebastes ovalis	Speckled rockfish	Both	Adults	18	76	152	366	32	32	38	42.8	H	Committee approved map. Only associated with rock(Done)
64	Sebastes ovalis	Speckled rockfish	Both	Juveniles		30	89		32	32	38	42.8	H	
64	Sebastes ovalis	Speckled rockfish	Unknown	Larvae					32			42.8		
65	Sebastes paucispinis	Bocaccio	Both	Adults	50	100	250	475	29.75	32.5	42	56	SE	Committee approved map
65	Sebastes paucispinis	Bocaccio	Both	Juveniles	0	10	100	183	30	32.5	42	56	H	
65	Sebastes paucispinis	Bocaccio	Unknown	Larvae		0	100		30	32.5	42	56	H	
66	Sebastes pinniger	Canary rockfish	Both	Adults	18	50	250	425	31			56	SE	Committee approved map
66	Sebastes pinniger	Canary rockfish	Both	Juveniles	0			274	31			56	H	
66	Sebastes	Canary rockfish	Unknown	Larvae										

	SpeciesSci	SpeciesCommon	Gender	Lifestage	Abs Min Depth	Pref Min Depth	Pref Max Depth	Abs Max Depth	Abs Min Lat	Pref Min Lat	Pref Max Lat	Abs Max Lat	Date type	Notes and comments from the Technical Review Committee
	pinniger													
67	Sebastes proriger	Redstripe rockfish	Both	Adults	12	150	275	425	26.7			55	H	Use the HUD(DONE) (Committee approved map)
67	Sebastes proriger	Redstripe rockfish	Both	Juveniles					26.7			55		
67	Sebastes proriger	Redstripe rockfish	Unknown	Larvae					32.8			55		
68	Sebastes rastrelliger	Grass rockfish	Both	Adults	0	0	15	56	28.9	30	43	44.6	H	Committee approved map
68	Sebastes rastrelliger	Grass rockfish	Both	Juveniles		0	15		28.9	30	43	44.6	H	
68	Sebastes rastrelliger	Grass rockfish	Unknown	Larvae					28.9			44.6		
69	Sebastes rosaceus	Rosy rockfish	Both	Adults	7	40	150	262	28	31	40	48	H	Only found on rock and structures(Done)
69	Sebastes rosaceus	Rosy rockfish	Both	Juveniles	27	30	61		28	31	40	48	H	
70	Sebastes ruberrimus	Yelloweye rockfish	Both	Adults	25	91	180	475	32.5	38	54	55	H	Missing rocks at geaboldi reef and also close waters outside Newport.(Done, do not have the rock data)
70	Sebastes ruberrimus	Yelloweye rockfish	Both	Juveniles	15		80		32.5	38	54	55	H	
70	Sebastes ruberrimus	Yelloweye rockfish	Unknown	Larvae					32			55		
71	Sebastes babcocki	Redbanded rockfish	Both	Adults	49	150	450	625	32.5			55	S	
71	Sebastes babcocki	Redbanded rockfish	Both	Juveniles					32.5			55		
72	Sebastes rubrivinctus	Flag rockfish	Both	Adults	30	60	200	418	28			44	H	Redo to 44 (Done)
72	Sebastes rubrivinctus	Flag rockfish	Both	Juveniles	0			224	28			44	H	Habitat association in HUD is not correct. Preferred min depth 70 and preferred max depth

	SpeciesSci	SpeciesCommon	Gender	Lifestage	Abs Min Depth	Pref Min Depth	Pref Max Depth	Abs Max Depth	Abs Min Lat	Pref Min Lat	Pref Max Lat	Abs Max Lat	Date type	Notes and comments from the Technical Review Committee
														180.
72	Sebastes rubrivinctus	Flag rockfish	Unknown	Larvae					28			44		
73	Sebastes saxicola	Stripetail rockfish	Both	Adults	10	10	350	547	27.8	33	49	55	SE	Committee approved map
73	Sebastes saxicola	Stripetail rockfish	Both	Juveniles	10	60	100	224	27.8	33	49	55	H	
73	Sebastes saxicola	Stripetail rockfish	Unknown	Larvae					27.8			55		
74	Sebastes serranoides	Olive rockfish	Both	Adults	0	0	75	174	28.3	34.3	39	41.3	H	Association for the water column is incorrect, should be rock(Done)
74	Sebastes serranoides	Olive rockfish	Both	Juveniles					28.3			41.3		
74	Sebastes serranoides	Olive rockfish	Unknown	Larvae					28.3			41.3		
75	Sebastes serriceps	Treefish	Both	Adults	3	3	60	97	28	28	34.5	37.5	H	
75	Sebastes serriceps	Treefish	Both	Juveniles			30		28			37.5	H	
75	Sebastes serriceps	Treefish	Unknown	Larvae					28			37.5		
76	Sebastes variegatus	Harlequin rockfish	Both	Adults	49	100	350	558	44	49	60	60	H	Committee approved map
76	Sebastes variegatus	Harlequin rockfish	Both	Juveniles	6				44	49	60	60		
76	Sebastes variegatus	Harlequin rockfish	Unknown	Larvae					52			54.5		
77	Sebastes zacentrus	Sharpchin rockfish	Both	Adults	25	100	350	475	33	36.5	60	60	S	Committee approved map
77	Sebastes zacentrus	Sharpchin rockfish	Both	Juveniles	25			475	33	36.5	60	60	H	
77	Sebastes zacentrus	Sharpchin rockfish	Unknown	Larvae	270			2800	33	36.5	60	60	H	
78	Sebastes rufus	Bank rockfish	Both	Adults	31	100	270	500	27.5	27.5	39.5	44.6	S	Committee approved map
78	Sebastes rufus	Bank rockfish	Both	Juveniles	25			247	27.5	27.5	39.5	44.6	H	

	SpeciesSci	SpeciesCommon	Gender	Lifestage	Abs Min Depth	Pref Min Depth	Pref Max Depth	Abs Max Depth	Abs Min Lat	Pref Min Lat	Pref Max Lat	Abs Max Lat	Date type	Notes and comments from the Technical Review Committee
79	Sebastes borealis	Shortraker rockfish	Both	Adults	25	100	600	875	39.5			55	H	Rerun absolute min lat 34.5. (Done)
79	Sebastes borealis	Shortraker rockfish	Both	Juveniles					39.5			55		
79	Sebastes borealis	Shortraker rockfish	Unknown	Larvae					39.5			55		
80	Sebastes reedi	Yellowmouth rockfish	Both	Adults	137	275	366	366	39			57	H	
80	Sebastes reedi	Yellowmouth rockfish	Both	Juveniles	137			366	39			57	H	Missing rocks up north as all other species, rockiest area on the coast (Done)
80	Sebastes reedi	Yellowmouth rockfish	Unknown	Larvae					39			57		
81	Sebastes rosenblatti	Greenblotched rockfish	Both	Adults	55	61	396	491	28	28	38	40	H	Use the HUD instead of survey (Done). Committee approved map
81	Sebastes rosenblatti	Greenblotched rockfish	Both	Juveniles					28	28	38	40		
81	Sebastes rosenblatti	Greenblotched rockfish	Unknown	Larvae					28.5			37.5		
82	Scorpaena guttata	California scorpionfish	Both	Adults	0	2	50	183	25.6			37	H	Committee approved map. Only associated with rock(Done)
82	Scorpaena guttata	California scorpionfish	Unknown	Eggs					25.6			37		
82	Scorpaena guttata	California scorpionfish	Both	Juveniles					25.6			37		
	Salmon	Salmon	Both	Adults										
	Brachyuran	Crabs	Unknown	Larvae										

Annex 2: Ad Hoc Groundfish Habitat Technical Review Committee Statement

The Council's Ad Hoc Essential Fish Habitat Technical Review Committee met September 8 and 9, 2005 to review updated habitat maps for Groundfish FMP species.

The participation of experienced fishermen in the Committee was invaluable in pointing out needed corrections to habitat maps based on their observations of fish distribution and bottom type. Their participation was made possible through financial assistance provided by the Port Liaison Project. The Committee found extensive value in the collaborative discussions of fishermen with survey scientists, and encourages the Council to further this collaboration.

The Committee reviewed the maps for all adult life stages and a large proportion was agreed on as an appropriate representation. The Committee found that the updated maps are a significant improvement over the previous versions reviewed at the December 2004 meeting and that the process of preparing these maps based on available data is proving to be a valuable exercise in furthering understanding of habitat use by managed species. However there are several areas of inaccuracies that need to be addressed further prior to publication of the Council's final EIS:

1. the distribution of semi-pelagic rockfish such as widow, yellowtail and black rockfish is not adequately captured by the existing maps; the committee recommends that the HSPs be updated to reflect association with only known rocky substrate; and,

2. The habitat distribution of several southerly distributed (California) rockfish species (e.g. black and yellow rockfish and starry rockfish) that are limited to rocky habitat are shown to extend over sand and mud habitat. The appropriate habitat association corrections should be made.

The Committee expects that updated maps correcting the above concerns (detailed report by MRAG Associates to follow describing corrections made to maps of the species in question) will serve as a valuable appendix to the Council's final EIS. However, the Committee also notes that the maps reflect our understanding of groundfish habitat distribution based on broad parameters of latitude, depth, stratigraphy and bottom type. While this approach has proved effective in preparing maps of the Pacific coast suitable for identification of EFH in the Groundfish FMP, the output is understandably imperfect, and should be improved over time. The maps represent a reasonable expectation of the suitability of habitat for groundfish, but are emphatically not representative of levels of abundance for any given species; comparisons between maps for different species should be made with caution. Production of the maps has been valuable in identifying important data gaps and limitations that result in under-representation of habitat suitability in some areas, and over-representation in other areas.

Continued collection and processing of substrate typing and mapping information is needed, especially:

1. off of the Olympic Peninsula and at the mouth of the Straits of Juan de Fuca, where accurate habitat discrimination data are not available; and
2. for nearshore rocky features, which are generally underrepresented due to lack of geological substrate data.

The Committee also noted that because:

1. survey information is understandably confined to summer months, this can contribute to seasonal biases in our perception of habitat use. For example, the map of petrale sole suitable habitat misses deeper water winter spawning areas; and,

2. because of the relatively weak understanding of nearshore rocky features the habitat distribution of several rock-associated nearshore species with shallow depth distribution is poorly represented. Affected species include cabezon, kelp greenling and several nearshore rockfishes.

The comments of experienced fishermen participating on the Committee were invaluable in contributing to this set of maps; continued efforts to incorporate fishermen's knowledge will improve future versions.

The Committee recommends that each map be accompanied by a small table indicating the data sources used. A picture of the species under discussion on each map would also help to avoid confusion, especially because, as noted during discussion between scientists and fishermen, common names of species often blur the lines among some species.

It is imperative that, whilst the current map outputs represent the best use of available data that was available, continued efforts are made to incorporate new data as they become available and that focused research effort is applied to address the data gaps identified as a result of this work. It is therefore finally suggested that to further the continued development of the map products and underlying model that an appropriate institutional "home" is sought that has the capacity and resources to undertake such work.

Agenda Item C.3.c
SSC Report
June 2005

SCIENTIFIC AND STATISTICAL COMMITTEE REPORT ON GROUNDFISH ESSENTIAL FISH HABITAT ENVIRONMENTAL IMPACT STATEMENT – FINAL PREFERRED ALTERNATIVE

At the March 2005 meeting, the SSC heard an update from Mr. Steve Copps (NMFS) on recent progress in preparing the groundfish EIS for EFH. The updated draft EIS document was distributed in March for further consideration at the April Council meeting. He noted that the present draft of the EIS is substantially changed and addresses many of the concerns expressed previously by the SSC.

Also at the March 2005 meeting, the SSC reviewed the Oceana Methodology for identifying areas of EFH that would be closed to bottom trawling and listened to presentations by Jim Ayers and Jon Warrenchuck (Oceana), and Geoff Shester (Stanford). Oceana's stated objective for EFH is to protect habitat while maintaining vibrant fisheries. The Oceana alternative is included as one of the alternatives in the draft EIS. The Council included the Oceana alternative as preliminary preferred Alternative number 12.

The Oceana approach considers coral and sponge habitats to be of particular importance to groundfish and referred to the EFH final rule, which states that it is not appropriate to require definitive proof of a link between fishing impacts to EFH and reduced stock productivity before Councils can take action to minimize adverse fishing impacts to EFH to the extent practicable.

The Oceana alternative seeks to establish an open trawling area by subtracting the area to be protected from the total fishing area, effectively freezing the bottom trawl footprint. Trawl logbook data from 2000-2003 were used to establish the proposed bottom trawl footprint. Areas within the proposed bottom trawl footprint were identified as areas of EFH that would be closed to bottom trawling based on 5 criteria. Observer data were not explicitly used to identify biogenic habitat, rather they were used to corroborate determinations from other sources. Approximately 14,000 km^2 of 90,000 km^2 within the bottom trawl footprint were identified as areas of EFH that would be closed to bottom trawling.

Oceana used multiple criteria to evaluate areas for closure, not just records of structure-forming invertebrates from trawl and submersible surveys. These additional criteria included; 1) a database of areas considered untrawlable during the shelf survey, 2) substrate characteristics (hard bottom habitat, including rocky ridges and rocky slopes), 3) bathymetric features (canyons, gullies and seamounts), and 4) areas with high habitat suitability from the EFH analysis. Areas labeled biogenic in the Ocean alternative were identified primarily from records of structure-forming invertebrates.

At the March meeting a considerable amount of SSC discussion focused on what criteria were used to define areas to be closed to fishing. The SSC noted that trawl survey data are not adequate to formulate a comprehensive model of coral and sponge distribution. An analysis of the density of positive trawl samples (for invertebrates) was used as a basis for drawing polygons enclosing discrete areas. The SSC noted that the analysis, because it is an analysis of positive tows only, is probably not the best metric of habitat forming invertebrate distribution; a presence/absence analysis may be more robust. It is clear that groundfish trawl surveys are not the ideal tool for sampling invertebrate distribution and abundance.

Observer data from bottom trawl fishing vessels, aggregated in blocks, were also analyzed as a secondary data source. Oceana reported that these data corroborated the trawl survey analysis and recommended increased observer coverage to document invertebrate distribution. The SSC noted that increased observer coverage may not be the solution. Special studies are essential to further understand the biogenic structure and its linkage to groundfish production.

Oceana indicated to the SSC its expectation that the Council would provide an analysis of long-term economic benefits of their alternative in the Draft EFH EIS. The SSC notes that such analysis is not feasible without more definitive information on long-term effects of habitat protection on fishery yield.

At the April meeting of the SSC, discussion on EFH again focused on the Oceana methodology. The SSC noted that, while Oceana's work is a good start in beginning the process to identify locations where biogenic habitats may exist, much work is needed to produce reliable and detailed maps showing the spatial distribution of biogenic habitats.

The SSC recommends new, scientifically designed surveys be developed to explicitly assess EFH. Such surveys could employ new technologies utilizing undersea quantitative video deployed on Autonomous Underwater Vehicles (AUV's), Remote Operated Vehicles (ROV's), and manned submersibles.

The SSC recommends that the Council explore an adaptive approach as it enters into the realm of spatial fisheries management. If planned carefully, incremental gains in knowledge could follow from studies designed to evaluate the effects of fishing (and not fishing) on a habitat-specific basis.

In conclusion:

1. There remains scientific uncertainty as to whether or not sponge and corals are essential fish habitat for the species in the groundfish FMP, but they are longlived and undoubtedly easily damaged by bottom trawling.

2. Trawls were not designed to sample sponge and coral organisms.

3. The NMFS groundfish trawl survey was not designed to identify or sample sponge and coral habitat.

4. Trawl fishery data may not adequately identify biogenic habitat.

5. Given these caveats and data limitations, the SSC considers the Oceana methodology to be a reasonable first attempt at identifying invertebrate distributions. However, the SSC cautions that if this approach is used to designate EFH these designations should be reviewed and modified, if necessary, as data from more appropriate surveys become available.

6. The SSC will incorporate research and data needs with regard to groundfish EFH into the next update of the Council's Research and Data Needs document.

<u>The Committee was given the following charge:</u>

1. Evaluate the range of alternatives in the EFH DEIS to determine if they provide a "reasonable technical range" of alternatives that achieve applicable objectives, foster options, are reasonable, not arbitrary, and not capricious.
2. Review the EFH designation model for output errors.

The technical range of EFH alternatives is technically adequate in that it uses the best available science to profile the range of suitable habitat for groundfish at the scale of the coast. The best available data does not support accurate results at more localized scales for all species/life stages and application beyond EFH designation should be treated cautiously. The range of alternatives is reasonable from a policy perspective by representing different levels of precaution. However, the TRC identified a number of technical issues related to data accuracy that must be addressed before EFH identification in the FMP is changed. All of the maps and the HUD need to be scrutinized to be considered reliable. However, the TRC acknowledges that the HSP approach and the data consolidated for the EIS is an important advance that, with updates and maintenance, will continue to improve the Council's and NMFS ability to effectively manage EFH.

The range of HAPC alternatives is technically adequate in that it is based on the best available data and presents the Council with a broad range of choices. The TRC notes the need to update and maintain the databases assembled for the EIS so that the Council and NMFS can refine any designations in the future.

The range of Impact Minimization alternatives is technically adequate in that it incorporates the full range of management tools (e.g. area closures, effort reduction, and gear modifications) over a broad range of habitat types and options. The TRC notes that the alternatives are designed to address physical modification to habitat and potential changes in biodiversity that may result from fishing. This approach is consistent with the best available science.

The range Research and Monitoring alternatives is not technically adequate because it fails to include all of the research components that would be necessary to improve the databases and models developed for the EIS. The TRC recommends it's mission be amended to develop a focused research plan.

Specific technical comments are also provided below.

<u>EFH Identification and Description Alternatives</u>

1. The range of the EFH designation alternatives may be constrained at the low and and perhaps a 20% HSP threshold option should be added to broaden the technical range.

2. On the other hand, there was concern that low HSP thresholds may reduce the feasibility of the range of alternatives (such alternatives may not designate sufficient habitat to achieve EFH designation mandates).
3. HSP target levels lack clear rationale in the current draft of the EIS.
4. The selection of HSP thresholds is not governed by a clear decision rule. While it is not feasible to develop such a decision rule at this time, it should be the subject of future work.
5. The historical (prior to trawl surveys and habitat mapping) suitability of habitat is probably not well characterized.

HAPC Designation Alternatives

1. B.7 includes canyons, banks, escarpments, ridges, seamounts, and other specific habitat types. However, all areas that represent those types of habitat are not included.
2. B.8 represents an anthropogenic habitat type; however, not all anthropogenic habitat types are included.
3. The range of alternatives appears to be adequate but no individual alternative is comprehensive. The final FMP amendment is likely to be a bundle of alternatives. The final bundle should contain sufficient diversity of habitat types and area to meet HAPC criteria.
4. B.9 is limited to “new” HAPC designation. It would benefit from clarification if it also applies to modification or deletion of current designations or if it is solely for designation of new HAPCs. It was noted that existing processes are in place that can be used to modify or delete HAPCs. B.9 should be included in the final bundle.
5. Some of the HAPC alternatives apply to fishing as well as non-fishing. The link to habitat degradation (criteria 2) lacks clarity and rationale in the current draft of the EIS.

Impacts Minimization Alternatives

1. The application of alternative c.2 to the specific fisheries needs to be made clear. Some of the options may result in total closure of the Dungeness fishery although it is not clear as written in the current draft of the EIS. This may apply to other alternatives as well.
2. The consequences of alternative c.2 are that safety may be compromised because small footrope may dig into the mud. This may also cause increased habitat degradation.
3. The spatial extent of separate alternatives is not similar. Any final bundle of alternatives should be regional in scope.
4. It is not clear as written that C.4 option 2 includes all seamounts.
5. There is some concern that the sensitivity and recovery indices are based on studies that occurred in areas other than the West Coast.

Research and Monitoring

1. Alternatives omit the need to update and maintain the habitat maps (HUD/HSP) and it should be included. New research to improve the resolution and spatial extent of the habitat maps is an explicit part of this process.
2. The HUD has not been reviewed and this team has found that to be a significant impact on the HSP maps. Consequently, the HUD needs comprehensive review.
3. Alternatives should include enhanced observer coverage for all gear types and fisheries.
4. Include an alternative to improve Sensitivity and Recovery values with or without research reserves.
5. Include an alternative to improve knowledge of ecosystem function of habitat with or without research reserves.
6. The committee lends its support to initiatives to enter haul-back points from existing log book data.
7. Care should be taken to ensure VMS data is or will be usable for EFH purposes.

Other Notes

- if the TRC continues, the fishing industry representative vacancy from California should be filled.

SUMMARY MINUTES

Groundfish Subcommittee
Economics Subcommittee
Scientific and Statistical Committee

Pacific Fishery Management Council

- ❧ -

Alaska Fisheries Science Center
7600 Sand Point Way N.E., Building 4, Room 2039
Seattle, Washington 98115
May 24 - 25, 2004

MONDAY, MAY 24, 2004

Call to Order

Dr. Michael Dalton called the meeting to order at 1 p.m. He reviewed the agenda and the tasks before the subcommittees, noting the last meeting on February 23-24, 2004.

Subcommittee Members in Attendance:

Dr. Steven Berkeley, Long Marine Laboratory, UCSC (Groundfish Subcommittee)
Dr. Michael Dalton, California State University, Monterey Bay (Chair, Economics Subcommittee; Groundfish Subcommittee)
Dr. Martin Dorn, NMFS Alaska Science Center (Groundfish Subcommittee)
Mr. Tom Jagielo, Washington Department of Fish and Game (Groundfish Subcommittee)
Dr. Andre Punt, School of Aquatic and Fishery Sciences, University of Washington (Groundfish Subcommittee)
Dr. Hans Radtke, Yachats, OR (Economics Subcommittee)
Ms. Cindy Thomson, NMFS Southwest Fisheries Science Center (Economics Subcommittee)

Not Present:

Dr. Ray Conser (Groundfish Subcommittee)
Dr. Han-Lin Lai (Groundfish and Economics Subcommittees)
Dr. Steve Ralston (Chair, Groundfish Subcommittee)

Others in Attendance:

Mr. Steve Copps, NMFS Northwest Region
Ms. Allison Bailey, Terralogic GIS
Dr. Robert Burn, University of Reading
Dr. Kit Dahl, PFMC
Dr. Ray Grizzle, University of New Hampshire
Dr. Mike Hirshfield, Oceana
Mr. Scott McMullen, EFH EIS Habitat Technical Review Committee
Mr. Graeme Parkes, MRAG Americas, Inc.
Mr. John Warrenchuk, Oceana
Ms. Suzanne Russell, NMFS, Northwest Fisheries Science Center
Dr. Waldo Wakefield, NMFS, Northwest Fishery Science Center (EFH EIS Habitat Technical Review Committee)

NMFS Report

Mr. Steve Copps, Project Manager for the EFH EIS, emphasized that it is important for the fishing impacts model be fully vetted and while acknowledging some shortcomings in this component.

Recap of Decision-making Framework and Introduction to Risk Assessment Document

Mr. Graham Parkes reviewed the overall decision-making framework and what is covered by the impacts model component. Dr. Martin Dorn asked about the relationship between the EFH designation model component and the impact model component. He also wondered if habitat suitability and the distribution of impacts could be compared spatially. Mr. Parkes indicated that this would be feasible.

Data Update

Dr. Ray Grizzle described how the habitat sensitivity and recovery indices were developed based on a review of the scientific literature. Subcommittee members asked that future descriptions describe more explicitly how the indices were formulated, particularly with respect to interpolation within the gear/sensitivity/recovery matrices. There were also questions about some of the specific values within the matrices. It was also noted that a Bayesian belief network model could be used to assign values in the matrices. Although there was not enough time to develop such a methodology for this project, it could be applied for a similar project in the future.

Dr. Grizzle also discussed the framework for evaluating nonfishing impacts, although this has not been developed as a model component. Subcommittee members discussed the types of nonfishing impacts that may be considered. The issue of positive impacts was raised, for example deployment of artificial reefs, and how they could be evaluated. It was pointed out that the regulatory framework for EFH presumes that all human-induced change is considered negative.

Ms. Bailey provided an update on data integration within the GIS, with particular attention to trawl logbook data. Subcommittee members discussed the problems with lack of data that resulted in the model only evaluating trawl gear impacts. The differences in the effects of gear types was discussed and it was pointed out that the sensitivity/recovery indices are specific to gear types. There was also further discussion of how nonfishing impacts might be addressed within the GIS framework. Given the limits on available spatial data related to nonfishing impacts the subcommittee recommended not pursuing more data gathering at this point.

Explanation of the Impacts Model

Dr. Burn described the impact function used to relate units of effort to the cumulative equivalent effects index, which includes habitat sensitivity and time-dependent recovery. Because there is no empirical basis for relating a unit of effort to unit of impact, an arbitrary tuning constant “k” was added to the logistic function. Subcommittee members raised several concerns. In the GIS, fishing effort is cumulated within 10' x 10' lat.-long. cells, which may contain parts of several habitat type polygons. However, it is unlikely that effort is uniformly distributed across constituent habitats. Members discussed approaches that would assign effort directly to habitat polygons or account for the nonrandom distribution of effort within cells. The subcommittee also discussed the implications of only using start positions and the likelihood that a trawl tract might cross more than one habitat polygon. The EFH EIS team recognized this problem, but given data limits assumed it would average out. The team also discussed their rationale for using the 10' x 10' cells rather than the actual habitat polygons. The subcommittee asked the team to provide plots of families of effort/impact curves (for different sensitivity values) using different values for k, the tuning constant. There was further discussion of developing guidelines for how model outputs should be used. The team said they would also present an analysis of the relationship between habitat for one species and fishing impacts.

Public Comment

Dr. Mark Hirshfield, Oceana, noted the importance of the sensitivity and recovery index value to the assessment process and noted that this were developed by reviewing a relatively few published studies. He wondered if the basis for these indices should be reviewed by a wider group of scientists and should be examined more critically.

<u>TUESDAY, MAY 25</u>

Application of the Risk Assessment

Mr. Graeme Parkes gave an overview of the development of alternatives for the EFH EIS and how the impacts model, and the analytical framework as a whole, could be used to aid that process. In addition to implementation of mitigation measures in the short term, long-term problems of data gaps and model improvement could be a component of the alternatives. Subcommittee members raised concerns about the process for tuning the impacts model (finding the appropriate value for the constant k). There was a question about what type of economic analysis would be included in the EIS. Although an economic modeling component is proposed for the analytical framework, in the short term for the EIS analysis it is likely that a more qualitative evaluation would be included. Research reserves were suggested as a possible component of alternatives to address the issue of limited data on habitat impacts.

In response to the subcommittee's concerns about determining an appropriate value for k Dr. Burn developed a methodology which finds the value of k based on setting the maximum level of effort (x) across all cells so that the impact value approaches the asymptote (maximum impact) for the habitat with the lowest sensitivity index value. Dr. Dorn presented an alternative model equation for finding impact, based on estimates of the area of habitat impacted by the fishing gear compared to the total area in an effort cell. This could be used as a way to compare solutions for k. Based on further discussion, the subcommittee felt that the impacts model is not ready for use in the policy process both because of the difficulty in finding the appropriate relationship between fishing effort and impact, given the lack of empirical data, and as a result the difficulty in predicting the magnitude of any change in habitat condition resulting from a management intervention. EFH EIS team members emphasized that the model was never intended to predict absolute impacts, only to show the spatial distribution of relative impacts. It could thus be used to identify and prioritize areas where management measures should be applied but not to determine actual costs and benefits of the application of a management measure. Other tools and information outside the model, but part of the overall analytical framework, could be used in conjunction during the policy process (development of EIS alternatives). Discussion expanded to the types of data gathering that should be carried out to support modeling and how the modeling exercise might help to determine what types of data should be gathered.

The meeting broke for lunch and reconvened at 1:00 pm. Discussion turned to the types of mitigation measures that might be proposed as part of the EIS and how the fishing impacts model could support this type of decision making. It was again pointed out that the model can show areas where impacts are likely occurring but not the magnitude of those impacts. The subcommittee also discussed decision making about the level of risk aversion that should be assumed in proposing mitigation. The SSC's role is to point out risk-neutral solutions while it is the Council's role to choose risk-averse strategies. The problem of the EIS being developed without a clearly articulated problem statement was discussed. It was suggested that future efforts should focus on determining the location of corals and appropriate mitigation for impacts to them. Dr. Dorn suggested that a simple index that is the product of the sensitivity and recovery indices could be used to plot the location of habitats vulnerable to different gear types. It was suggested that the fisheries data system should be rethought with an eye to gathering information relevant to habitat and habitat impacts.

Public Comment

Mr. John Warrenchuk, Oceana, noted the need to re-evaluate the sensitivity and recovery index values developed thus far by expanding the information sources that are used. He noted the data gaps with respect to biogenic habitat, especially in relation to different substrate types. He suggested that conditional probabilities be assigned for the existence of corals and other biogenic features on different bottom types. He noted that the observer program logs both set start and end points and an intermediate point. These data may be useful for modeling.

Development of Draft SSC Report

The Subcommittee met from 2:30 to 3:30 pm to discuss their recommendations for the report. The meeting adjourned at about 3:30 pm.

A Review of Analytical Portions of the Environmental Impact Statement for Designating Groundfish Essential Fish Habitat

– A Report of the SSC Groundfish Subcommittee –
Based on a Meeting Held at the Alaska Fisheries Science Center, February 23-24, 2004

SSC Members Present:

Steve Ralston (chairman)
Martin Dorn (rapporteur #1)
Mike Dalton (rapporteur #2)
Steve Berkeley
Tom Jagielo
Han-Lin Lai

Introduction

NOAA Fisheries is developing an Environmental Impact Statement (EIS) in response to a court order and settlement agreement to conduct a new NEPA analysis for Amendment 11 to the Pacific Fishery Management Council's (PFMC) groundfish Fishery Management Plan (FMP). Work on the EIS officially started in March 2002, when a team of NMFS and NOS scientists convened to devise a strategy and to identify data sources and responsible parties. The team identified the comparative risk assessment model described by the NRC[1] as the conceptual starting point for the Pacific coast groundfish Essential Fish Habitat (EFH) EIS. The PFMC reviewed the decision-making framework in April 2002 and subsequently formed the PFMC's Groundfish Habitat Technical Review Committee (TRC) to guide the assessment process.

The full Scientific and Statistical Committee (SSC) received an initial briefing by the EFH analytical team in June 2003. The schedule for designation of EFH by the PFMC is mandated by court order and requires that a range of alternatives be available for consideration at the June 2004 Council meeting. Scientific input has largely been provided to the analytical team by the Technical Review Committee (TRC) convened by the council. However, given the rigid schedule that is required for adoption of EFH alternatives by the PFMC and the role of the SSC in advising the Council about scientific and technical issues, a review of analytical tool that has be developed to evaluate EFH options was requested of the groundfish subcommittee of the SSC. That review was conducted February 23-24, 2004 at the Alaska Fisheries Science Center in Seattle, Washington. A substantial set of briefing materials were provided (Appendix 1) to the six members of the SSC that were present for the review (Ralston, Berkeley, Dalton, Dorn, Jagielo, and Lai).

It is clear that considerable advancement has occurred since the SSC was initially briefed by the EIS analytical team. The most substantial progress has been made on developing methods for characterizing and designating EFH. However, at the time of the review the fishing impacts model was not yet complete (see below).

The goal of the analytical team has been to bring a completed EFH assessment to the council at the April meeting, where preliminary alternatives for designating EFH will be presented. Council staff anticipated that the review by the groundfish subcommittee would constitute a "final check" before the completed assessment is brought before the Council. Although significant progress has been made, aspects of the analysis are incomplete (i.e., the fishing impacts model), precluding SSC endorsement of the full EIS assessment. Nonetheless, the subcommittee was able to fully review the analytical tool for designating EFH, for which methods have been most fully developed.

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[1]NRC (2002). Effects of Trawling and Dredging on Seafloor Habitat. National Research Council, Ocean Studies Board, National Academy Press, Washington, D. C., 136 p.

Review of Model for EFH designation

GIS layers for bathymetry and substrate

Geographic Information System (GIS) techniques are used extensively in the EFH analysis. Information in GIS is stored as "layers" that can be linked together by their geographic coordinates. Two basic layers are used to characterize benthic marine habitats: a bathymetric layer (latitude-depth) and a substrate layer (geology of the sea floor). These layers have been assembled from many sources by the EFH analytical team and are the most comprehensive datasets of bathymetry and substrate ever compiled for the West Coast. The area covered extends from the shoreline (including estuaries) to 3000 m. This area does not comprise the entire West Coast EEZ, but does encompass the nearly all of the known habitat for groundfish FMP species. Areas of potential interest further offshore include several seamounts that rise above 3000 m depth that may provide habitat for minor groundfish species such as Pacific rattail and finescale codling. Omission of seamounts is unlikely to be of consequence for the EFH analysis, although they may good candidates for HAPC designation. The technical team indicated they will close this information gap in time for the seamount data to be useful in the EIS process.

Ideally, the quality of the data in a GIS layer should be assessed when the layer is created. A data quality layer is potentially useful in subsequent analysis to incorporate uncertainty, particularly when using Bayesian Belief Networks (BBN). For Oregon and Washington, a data quality layer on a scale of 1-40 was produced for each data source, i.e., bottom grabs, side scan sonar, seismic, etc. Unfortunately, a similar layer has not been generated for California. For the bathymetry layer, a qualitative scale was proposed, whereby a single value would be assigned to the waters off each state. Uneven treatment of uncertainty by layer and by region makes it difficult to carry forward uncertainty in the analysis.

In BBN models, uncertainty is modeled with discrete misclassification matrix, which could be obtained by evaluating an imprecise data set using a more precise data set, or from expert opinion. Unless uncertainty has been evaluated when the original layers were prepared, it is difficult to treat uncertainty appropriately. One option is to simply omit the misclassification matrix to acknowledge the difficulty of treating uncertainty appropriately. Another alternative would be perform a sensitivity analysis with different levels of classification error. Parcels identified for EFH analysis are irregular in shape, and defined according to depth intervals. While the range of depths within a parcel is likely to differ somewhat from the depth intervals used to define the parcel, the entire parcel is unlikely to be belong to a deeper or shallower depth interval. Therefore, we recommend that depth uncertainty not be included in the EFH designation model.

Biogenic habitat

Biogenic habitat (e.g., kelp, sea grass, and structure-forming invertebrates) is both of potential importance to fish populations and potentially sensitive to fishing impacts. With respect to structure-forming invertebrates, however, the draft analysis only provides a map showing the locations of survey stations were these species have previously occurred. Because of the potential importance of these biogenic habitats, the subcommittee recommends additional effort to identify areas with biogenic structure, including especially the structure-forming invertebrates. The review panel is cognizant of the limitations of the NMFS surveys for this purpose, and does not intend to be prescriptive in recommending what additional analyses could be done. Several suggestions are:

1. There currently exists a GIS layer with distribution polygons that characterizes kelp cover. This layer is needed to identify essential habitat for species with specific affinity for kelp habitat. However, the spatial extent of kelp cover expands and contracts in response to environmental variability (e.g., El Niño). When habitat is dynamic in nature, defining EFH by fixed geographic coordinates is problematic. Since the compiled information on kelp cover is the maximum extent of kelp cover, the kelp GIS layer should be understood as an inclusive definition of this habitat. Sea grass habitat presents similar difficulties.

2. Some structure-forming invertebrates are found primarily on soft bottom, and would be sampled effectively in the NMFS trawl surveys. Example include sea whips and perhaps sponges. For these soft bottom invertebrates, maps of relative CPUE by station should be produced.

3. The draft analysis argues that NMFS survey data are not adequate to produce a comprehensive map of hard-bottom coral off the West Coast. It is impossible to assess the adequacy of the survey data without first taking steps to map relative abundance. This exercise could also help to emphasize the need for further research into coral distribution, and ought to be included in the final analysis. Some areas of the West Coast EEZ have been surveyed using ROVs (i.e., Hecata Bank, parts of southern California). Assessing the distribution of coral in these areas is feasible. If at all possible, information on coral distribution in these areas should be included in the EFH analysis.

Modeling fish distribution

The NMFS guidelines for EFH describe a hierarchy of information that can be used to designate EFH. At level 4 (the highest) information is available on production rates by habitat. For the West Coast (as elsewhere), the information available for EFH designation is at level 2 (habitat-related density) and at level 1 (distribution data). Trawl CPUE is not explicitly habitat-related because substrate is not determined at sampling stations. Interpretation is also problematic because not all substrates are sampled equally well using trawls. The analytical team has devised an approach based on fitting generalized additive models (GAM) to presence/absence information (level 1) from trawls by latitude and depth (i.e., level 1). This approach ignores information on relative density from trawl surveys. While there are good reasons for adopting this approach, the change from a level 2 to level 1 analysis needs to be more carefully justified in the EFH analysis.

The information from literature review entered into the Habitat Use Database (HUD) is used to establish the species-substrate association. Habitat maps produced by EFH analysts show the "habitat suitability probability," which is calculated as the product of probability of occurrence by latitude and depth (from the GAM model) and strength of the species-substrate association. This quantity can be regarded as an estimate of how likely it is that the species will be encountered in a habitat, so perhaps the nomenclature should reflect this. Habitat suitability is a relatively vague concept that implies more about the importance of a particular habitat than is perhaps warranted.

The approach to modeling of EFH has evolved considerably from the initial NOS models used for assessment of central California marine sanctuaries. Rather than polynomial regression using the logarithm of mean survey CPUE, the EFH model is a GAM model for the probability of occurrence. The final modeling approach is based on appropriate error assumptions and careful attention to goodness of fit. Nevertheless, there is some concern that the modeling approach does not make fullest use of the survey information on relative densities. GAMs and GLMs that can accommodate zero catches have been commonly used to obtain indices of abundance using West Coast trawl survey data for stock assessment. Furthermore, the limitations of presence/absence information to infer essential habit should not be ignored. For example, a species may have a broad depth or geographic distribution, but may only reach high densities in a limited area. Surveys provide limited information concerning the function of the habitat for a species. For example, winter spawning grounds for lingcod would not be necessarily be identified as essential habitat using summer survey data.

Existing surveys also have a strong bias towards habitats that can be trawled, and are of limited utility for identifying essential habitat for juvenile stages. For example, biogenic habitat may provide refugia from predation for juvenile fish, yet these habitats could not be identified as essential if the sampling gear does not capture juveniles. Although direct visual surveys are perhaps the best method for identifying species-habitat associations, these surveys are currently limited in scope. Size composition data are available for many groundfish from the NMFS trawl surveys. In many cases, juveniles can be reliably distinguished from adults on the basis of size. Many species occupy different habitats at different life history stages. Information about these ontogenetic shifts present in the trawl data is not being utilized in the present analysis. Therefore, while presence-absence analyses should be relatively robust, EHF designations resulting from such analysis are initial approximations that will need to be refined as additional information becomes available.

Habitat profiles have been generated for adults using GAM models and NMFS survey data for a limited number of species. Habitat profiles have not yet been obtained for egg, larval, and juvenile stages. These profiles will be generated using the HUD database, which will also be used for the adult stages of species which are not well sampled during trawl surveys. Although this work has not yet been completed, the subcommittee was able to review the proposed methods.

HUD database

The life history appendix to the previous EFH amendment to groundfish FMP has been made into relational database of habitat use (HUD). For each species, association with substrate type is characterized on a relative scale (unknown, weak, medium, strong). Depth preferences are characterized with four depths: minimum observed depth, minimum preferred depth, maximum preferred depth, and maximum observed depth. Geographic (latitude) preferences are recorded similarly. The preferred minimum and maximum depths (and latitudinal ranges) are roughly based on the 5th and 95th percentiles from surveys when these data are available.

The analytical team proposed an interpolation/smoothing procedure for inferring habitat suitability profiles using information on preferred depths and latitudes in the HUD. While trying to extract as much information as possible from limited data is laudable, there is some danger of over-interpreting data to obtain visually satisfying results. Linear interpolation is preferable to arbitrarily smoothed curves when obtained simply from preferred maximum and minimum preferred depths. Values used to control the shape of suitability profiles could be estimated objectively by comparison with survey-based profiles for species where both can be obtained.

Model for EFH designation

The Bayesian Belief Network model used for designating EFH appears to be a reasonable approach. The EFH model is a very straightforward application that does not depend heavily on BBN methodology (Fig. 1 shows the flow of information in the EFH habitat designation model.) The novelty of the approach should not be considered a significant issue.

The end result of the EFH analysis are maps by life history stage for each groundfish species that show on a qualitative scale the importance of different habitats to that species. EFH is determined by selecting habitats with scores higher than some predetermined value. A low value would produce a broad or inclusive definition of EFH, while a high value would reduce the area defined as EFH. The decision whether to adopt an inclusive or narrow definition of EFH should be considered from a policy standpoint. Adopting an inclusive definition may be appropriate given the incomplete and indirect nature of the information used to identify EFH. However, developing workable alternatives to reduce fishing impacts may be difficult if EFH is defined broadly. Adopting a relatively narrow EHF definition may make it easier to develop effective precautionary alternatives.

The GAM models estimate the probability of occurrence, while suitability profiles based on HUD database are scaled to have a maximum value of one. The probability of occurrence can have a maximum value considerably less than one, particularly for rare species where the probability of occurrence is low everywhere. EHF for individual species should be placed on common scale before they are combined in an EFH definition for all groundfish species. It may also helpful to produce intermediary maps showing EFH maps for various subsets of groundfish, i.e., overfished species, species guilds, or species complexes used for management. One promising alternative for EFH designation would identify the best 10% (or 20%, etc) of habitat over entire assessed region for each groundfish species, and then combine these areas for an overall definition of EFH.

Public comment concerning EFH

1. The final rule for NMFS guidelines discusses the need for different EFH definitions for overfished species.

2. There is concern about using a level 1 analysis (presence/absence) rather than a level 2 analysis (relative density).

3. Is HAPC contained within EFH? Answer: Criteria for defining HAPC are different than EFH. HAPC is not necessarily included in EFH.

4. There was public testimony concerning the importance of identifying areas with living structure (specifically, corals and sponges).

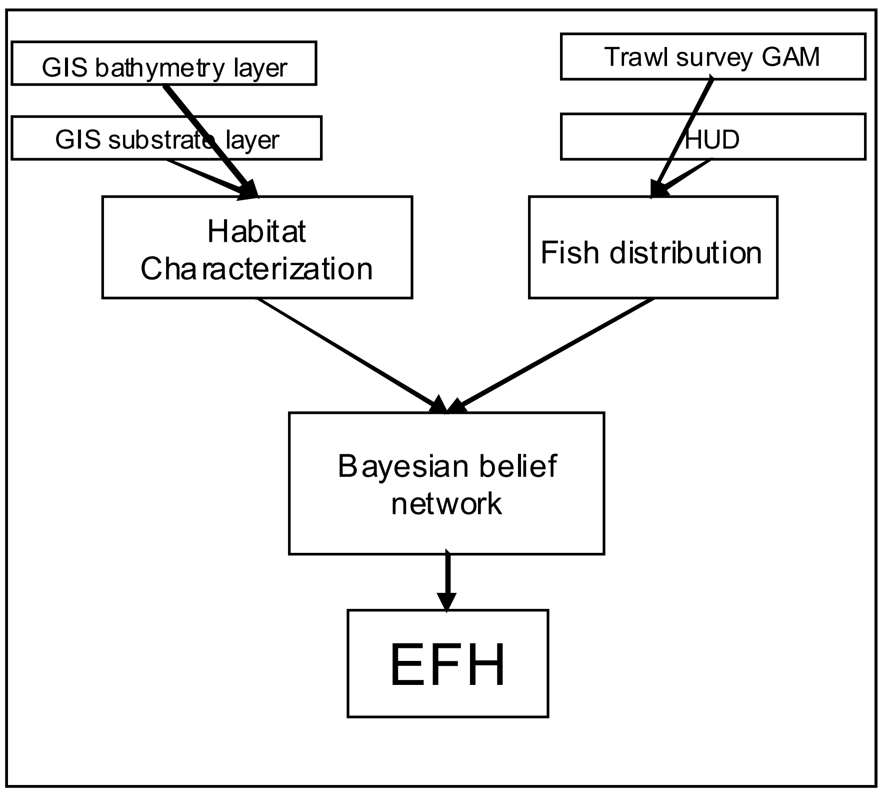

Figure 1. Flow of information for EFH habitat designation model.

SSC Review of the Impacts Model for the EFH EIS Process

Fishing Effort

Spatial data requirements of the EFH project stretch, and in many cases exceed, what are available for most West Coast fisheries. The most comprehensive spatial data for fishing effort on the West Coast are available from trawl logbooks, and work on the EFH project so far has relied exclusively on these data to measure the spatial distribution and intensity of impacts from fishing. The development of spatial data for fixed-gear sectors is an important objective for the EFH project's fisheries impacts model.

For the trawl fisheries, impacts are measured in the EFH project by total tow hours in a year at each location, or fishing block, where trawling occurred. This definition of fishing effort is appropriate for the EFH project.

No coast-wide source of spatial data for fixed-gear fisheries exists. Recently, the Ecotrust organization developed a model to estimate the coast-wide spatial distribution of fishing effort for fixed-gear and other groundfish fisheries using information from fish tickets, but the accuracy of these distributions was not tested. Wisely, the EFH project team investigated the potential reliability of using Ecotrust's effort distributions to represent spatial distributions of fishing effort in trawl, long-line, and groundfish pot fisheries. To check Ecotrust's effort distribution for one area, focus group meetings with knowledgeable fishermen were conducted to develop baseline effort maps for an area off the Oregon coast.

The focus group meetings for the EFH project were conducted under sound socioeconomic research protocols (Final Report, Pilot Project to Profile West Coast Fishing Effort). The SSC endorses the use of social science research methods to collect primary data based on fishermen's knowledge and expertise. The SSC encourages further use of these methods to continue collecting primary data on baseline fishing effort off the West Coast. These data would be used to develop baseline effort maps for other areas, and provide the best available science to the EFH-EIS process.

The focus groups produced a set of maps showing the spatial extent and intensity of fishing effort for trawl, long-line, and groundfish pot fisheries in an area between the ports of Newport and Astoria. Based on survey responses, fishermen in the focus groups were confident in the spatial extent of fishing effort depicted on the maps, but uncertain about the groups' estimates of the spatial intensity of fishing effort.

Maps from the EFH project's focus group were compared to Ecotrust's distributions of fishing effort for fixed-gear fisheries between Newport and Astoria over two recent time periods, 1997 and 2000. To show results, the EFH project team provided several maps that compare the baseline effort maps from the focus groups with Ecotrust's effort distributions. Results of the comparison are discouraging. For example, the areas reported by the focus groups for the fixed-gear fisheries were generally much larger and further from port than Ecotrust's distributions.

For the long-line fishery, Ecotrust's distributions cover 8-12% of the area reported by the focus groups. On the other hand, around 50% of each Ecotrust's distribution is outside that area. Results of the comparison for the groundfish pot fishery are worse. In this case, Ecotrust's distributions cover only 0-3% of the area reported by the focus groups, and 80-100% of each Ecotrust distribution is outside that area. In one case, the center of Ecotrust's distribution is more than 100 km from the area identified by the focus groups.

These comparisons reinforce the SSC's concerns, which have been described previously, regarding the spatial algorithm used by Ecotrust. Based on the above comparisons, the SSC is doubtful that the effort distributions derived from the Ecotrust methodology broadly represent baseline patterns of fishing effort in non-trawl fisheries. Consequently, the SSC cautions against relying on those effort distributions, to avoid biasing the estimated spatial distribution of impacts from non-trawl fisheries.

Effects of Fishing Gear on Habitat: Sensitivity and Recovery Rates

The EFH project team conducted an extensive literature review, and developed a database of gear effects for different habitat types. As with any multi-dimensional classification system, the number of cells requiring data grows quickly as more gear or habitat types are added to the database. Information to fill these cells is constrained by the literature review. To allow a reasonable number of cells, a scoring system was developed to rank gear effects with three levels each for sensitivity and recovery times (Tab. 2, p. 12, Appendix 10).

Data from the literature were standardized and a given a score in the range 0-3. For habitat sensitivity, zero represents minimal effects or no impact, and a score of three represents a major or catastrophic effects. Recovery times range from zero to periods lasting from three to seventeen or more years. For this reason, interpretation of the scores as real numbers is problematic. Nonetheless, scores are added together to calculate average scores for sensitivity and recovery rates.

The literature review provided a robust ranking of gear types by damage per unit effort, in increasing order: hook and line, pots and traps, nets, trawl, and dredges. The literature review also provided a robust ranking of habitat sensitivities to gear effects, in increasing order: soft bottom, hard bottom, and biogenic (broadly defined as having vertical biological structure).

The SSC notes the biogenic habitat category needs attention. Ideally, a refinement of this category could include corals, sea pens, or other invertebrates, but spatial data exist only to partly support this formulation. While the incomplete distributions may not be appropriate for use in the Bayesian network model, maps showing the spatial distribution of known biogenic features (e.g. corals in trawl surveys), and the distribution of fishing effort, would be useful for reference in future documents. In addition, the SSC notes that refinement of other categories, such as soft sediments, may also be advised.

Scores assigned to different gear and habitat types from the literature review involved subjective judgment. To address this issue, scores were assigned independently by a group of researchers that rated studies in the literature review. The mean of the individual scores, plus or minus a standard deviation, is used to represent low, medium, and high values for each gear and habitat type.

Overall, the SSC finds this method of constructing habitat sensitivity and recovery indices to be acceptable, but is concerned about whether data from the literature review are sufficiently representative of West Coast fisheries. Only 2 of the 89 studies included in the literature review took place in West Coast fisheries. Another potential source of bias is that 90% of the studies are about trawl or dredge gear.

Of particular concern to the SSC is the use of gear effect estimates from studies on New England trawlers to infer habitat effects from West Coast trawl vessels, which are usually smaller with different gear characteristics. Effects of trawling on hard-bottom shelf habitats are likely to be important in West Coast fisheries, and estimates of sensitivity and recovery for the hard bottom-shelf-trawl category in the EFH database are from only two studies (Tab. A10.2, Appendix 10 attachment). One study is about beam trawls, and the other was done in New England (Auster et al., 1996).

The SSC recommends investigating the relationship between gear effects and vessel size or fishing power, and if necessary controlling for this factor in the gear effects tables. A related issue that deserves further investigation is an assessment of each gear type's ability to access different habitat types.

Clarification is needed about relationships between the overall level of fishing effort and gear effects. For example in most cases, gear effects are measured for a single trawl, but replicates are sometimes used. Questions were also raised about whether replicate trawls occurred at exactly the same location. An important uncertainty in the data is that overall effort is controlled in the studies, and results may not apply, or may apply only in a limited way, to situations where effort is not controlled.

Fishing Impacts Model

The fishing impacts model for the EFH-EIS analysis is work in progress, and the SSC was unable to conduct a full review of the model at this time. The fishing impacts modeling team has a complex, and impressive, set of tasks to complete in order to accomplish its stated objectives. Fortunately, major computational challenges related to model development, and execution, have been solved, and a working version of the model and data were used to produce quantitative results for the effects of gear on fish habitat. The SSC appreciates the EFH project team's openness, particularly regarding suggestions about future model development.

Currently, the fishing impacts model is reduced to a single index value that is intended to represent a broad measure of status for fish habitat based on cumulative impacts. Fishing effort and sensitivity of habitat to gear type determine gross impacts. The fishing impacts model is dynamic, and effects of recovery and previous impacts determine net impacts. A simplifying assumption is that fishing effort is uniformly distributed over the year, which might ignore important seasonal effects. Dynamics of the habitat index value are based on a logistic difference equation, similar to population models. Parameters in the logistic equation are linked to habitat sensitivity and recovery rates from the gear effects tables described above.

The single index variable can be used with different model formulations. In one formulation, the index value represents a mean or average status for fish habitat over an entire area. An alternative formulation is to assume that fish habitat consists of many individual patches that follow a discrete two-state process between healthy and damaged conditions. Under this interpretation, the index value represents the fraction of patches in, for example, the damaged state. Either formulation has problems, and the SSC recommends developing a multivariate description of impacts, based on explicit and measurable physical effects of gear on habitat, in terms of individual species, or types of organisms.

Saturating functions for gross impacts, and logistic (S-shaped) recovery profiles are important features to be added to the fishing impacts model. The SSC notes that a stochastic or probabilistic model of fishing impacts may be appropriate. Another alternative worth considering is the development of a spatially explicit model of gear effects that incorporates the notion of a gear footprint, such as the area swept by trawls, and whether a focus group approach similar to that for fishing effort could be pursued to estimate footprints for different gear types.

Impacts from Non-fishing Activities

The EFH team's work on impacts from non-fishing activities is just starting, with some data but no model to review. Modeling the impacts of non-fishing activities is important, but the SSC recognizes these activities are outside the control of fisheries management.

Appendix 1. Briefing materials presented to members of the SSC Groundfish Subcommittee for their review of the EFH EIS analytical tool.

1. Pacific Coast Groundfish EFH – **Analytical Framework** (Version 4, February 10, 2004). Prepared for Pacific States Marine Fisheries Commission by (a) MRAG Americas, Inc., 110 South Hoover Blvd., Suite 212, Tampa, FL 33609, (b) Terralogic GIS, Inc., P.O. Box 264, Stanwood, WA 98292, (c) NMFS Northwest Fisheries Science Center, FRAM Division, and (d) NMFS Northwest Regional Office, 89 p.

2. Appendix 1: Active Tectonics and Seafloor Mapping Laboratory Publication 02-01 – Interim Seafloor Lithology Maps for Oregon and Washington (Version 1.0), by C. Goldfinger, C. Romsos, R. Robison, R. Milstein, and B. Myers, Active Tectonics and Seafloor Mapping Laboratory, College of Oceanography and Atmospheric Sciences, Oregon State Unversity, Burt 206, Corvallis, OR 97331, 11 p.

3. Appendix 2: Final Report – Essential Fish Habitat Characterization and Mapping of the California Continental Margin, by G. Greene and J. Bizzarro, Center for Habitat Studies, Moss Landing Marine Laboratories, Moss Landing, CA, 21 p.

4. Appendix 3: Organizations contacted for information on non-fishing impacts to EFH, 6 p.

5. Appendix 4: List of groundfish species in life histories appendix, 2 p.

6. Appendix 5: Gear types in the PACFIN data base, 2 p.

7. Appendix 6: Description of habitat suitability index (HSI) modeling conducted by NOS, 4 p.

8. Appendix 7: Development of profiles of habitat suitability probability based on latitude and depth for species and life stages in the Groundfish FMP, 34 p.

9. Appendix 8: Discrete time damage model for fishing impacts, 3 p.

10. Appendix 9: Useful websites on Bayesian Belief Networks, 1 p.

11. Appendix 10: Pacific Coast Groundfish EFH – The effects of fishing gears on habitat: west coast perspective (Draft 5), by MRAG Americas for the PSMFC, February 9, 2004, 32 p. + annex.

12. Appendix 11: Pacific Coast Groundfish FMP Habitat Use Database User Manual for Version 15B (Draft), 50 p.

13. Non-Fishing Impacts on Bottom Habitats – Draft 1 (February 19, 2004), 7 p.

14. Letter from Dr. M. Mangel to S. Copps (dated 17 October 2003) concerning the Ecotrust Methodology, 2 p.

15. Final Report – Pilot Project to Profile West Coast Fishing Effort Based on the Practical Experience of Fishermen, by T. Athens, A. Bailey, F. Conway, S. Copps, R. Fisher, M. Larkin, S. McMullen, and F. Recht, 31 p.

16. Fishing Effort GIS Data Exploration for West Coast Groundfish EFH EIS Project, Terralogic GIS, December 2003, 20 p. + appendices.

17. Excerpt from Northwest Power and Conservation Council's Independent Science Advisory Board Report on Salmonids Supplemental, Section 7. Benefit-Risk Assessment and Decision Making, 19 p.

Pacific Fishery Management Council Ad-hoc Groundfish Habitat 'Technical Review Committee
Meeting Decisions
Santa Cruz, California, November 20-21, 2003

- For modeling species with significant data gaps, investigate the use index species. Continue exploring where species can be considered a part of an assemblage. Consult with Wakefield and Yoklavich as this is developed.
- Model doesn't incorporate much information about other life stages. Apply Habitat Use Database to fill in where possible. The output from this approach will likely lack a high level of detail; however, the level of detail will be appropriate and true to the underlying data.
- For the fishing effort data, explore comparisons of the various sources of fishing effort data with each other to see congruence, being careful to compare like gear-types. Explore different types of comparisons such as fishing effort to substrate type; focus group information to logbook data, etc.
- For the gear impacts indices input to the impacts model, recovery times should be incorporated into the model in terms of low, medium and high, since don't know how to quantify the impacts. There is potential to use additional data on organism growth rates to inform this model.
- For the impacts model, stress the importance of a node that considers historical trends. This could be particularly important for areas that were impacted years ago but are now in advanced recovery.
- The TRC believes that the modeling approach that has been reviewed to date is a suitable analytical tool for assessing the status of fish habitat and the risks to habitat function posed by fishing and non-fishing activities in the Pacific area. It is recognized that this approach is occurring in a data poor environment and there must be expressed in terms of probability rather than hard numbers. The completed models should form a solid basis for developing EFH conservation policy.

DRAFT Meeting Summary
ad hoc Groundfish Habitat Technical Review Committee
August 4, 2003 by Teleconference

Participants

committee members: Scott McMullen, Mary Yoklavich, Gary Greene, Marc Mangel, Rod Fujita, Mark Powell (Chris Goldfinger, Marion Larkin, Tim Athens, and Waldo Wakefield were absent).

others: Flaxen Conway , Yvonne DeReynier, Steve Copps, Allison Bailey, Jennifer Hagan, Randy Fisher, Janice Searles, Kit Dahl, Jennifer Gilden, Dave Colpo, Bruce McCain, Marlene Bellman, Fran Recht, Joe Bizarro, Graeme Parkes, Runi Wilhelm.

Discussion Points and Decisions

1. Reviewed revised settlement agreement and EIS schedule. Per Council direction, the life of the committee is to be extended to allow for technical review of the range of alternatives that are adopted by the Council for analysis in the draft EIS. The draft EIS is to be published February 11, 2005. Committee membership under this new direction would be extended until at least the fall of 2004 and involve participation in 4 more in-person meetings. The full revised settlement is available at http://www.pcouncil.org/bb/2003/0603/exb11.pdf

Decision: Committee members will need to consider the increased level of committment required as a result of revised schedule. Steve will talk to all the committee members regarding continuing membership.

2. Reviewed Pilot Project to Profile West Coast Fishing Effort Based on the Practical Experience of Fishermen. Proposed methodology was presented by Scott McMullen, Flaxen Conway, and Steve Copps.

Decision: The committee voted unanimously to endorse implementation of the project.

staff notes: Staff recommends that the committee devote substantial time during the next meeting to fully explore all available sources of effort data and provide unambiguous guidance for completing this input to the impacts model. NMFS is working aggresively to fully describe the strength and weaknesses of the available data sources for the committee. Concurrently, MRAG Americas is developing the impacts model to accomodate whichever input(s) the committee determines best fits the modeling needs.

3. Reviewed GIS data on structure forming invertebrates. Allison Bailey presented.

Decision: Form working group to consider if the appropriate species have all been identified and to consider the data and its strengths and limitations especially in context with other GIS layers and how it might best be used.

4. Reviewed GIS data on managed areas. Allison Bailey presented.

   Decision: none discussed.

5. Reviewed GIS data on substrates data quality. Allison Bailey presented.

   Decision: pending availability of funds, develop data quality map for California.

6. Reviewed status of Habitat Use Database. Bruce McCain presented.

   Decision: none discussed.

7. Reviewed approach to habitat suitability modeling. Runi Vilhelm presented.

   Decision: model habitat suitability indices based on approach suggested by Runi.

8. Reviewed meeting schedule.

   Decision: next meeting to be held in November. Fran Recht to work with committee members to schedule.

Preliminary Recommendations of the
ad hoc Groundfish Habitat Technical Review Committee

The ad hoc Groundfish Habitat Technical Review Committee met February 19-20, 2003 in Seattle and made the recommendations outlined below. The committee was formed by the Pacific Fishery Management Council to guide a scientific assessment of Pacific Coast Groundfish Essential Fish Habitat.

1. The committee unanimously endorses the bayesian approach to modeling EFH/HAPC and adverse impacts but notes that a reasonable degree of caution is prudent at this point prior to the models being made final. Conclusive recommendations for utilizing the models as the foundation for policy decisions will be made after the committee reviews the final product.

2. The committee believes that the modeling process could proceed with the information that is currently available. However, it would be extremely worthwhile to make improvements to the data during the period of time it will take to fully develop and run the model. Specific suggestions are provided below.

3. The committee recommends that the next meeting occur in time to monitor progress and review preliminary model runs.

<u>Tasks</u>

- Complete risk assessment models (EFH/HAPC designation and adverse impacts).
- Contract for interpretation of literature on fishing gear impacts to develop a "west coast perspective." The interpretation would provide a key input into the risk assessment.
- Groundtruth fishing effort data. Compare observer data and input from fishermen with results of Ecotrust fishing effort model.
- Develop GIS layer of priority non-fishing activities for cumulative effects portion of risk assessment model.
- Develop GIS layer of priority invertebrate distribution by mining survey and other relevant data.
- Overlay benthic habitat GIS with data layer that indicates data quality.
- Complete GIS data layer of baseline regulatory areas that are protective of habitat.
- Build the NOS Habitat Suitability Index into the risk assessment models.
- Complete EFH Appendix database.