PROPOSED CHANGES TO THE CATCH SHARING PLAN AND 2008 ANNUAL REGULATIONS

Each September meeting, the Council considers proposed changes to the halibut regulations. The purpose of this consideration is for adjustments in the annual regulations (primarily in the recreational fishery) or catch sharing plan, and can include changes in catch allocation among areas or gear groups.

Attachment 1 contains the current catch sharing plan. The plan includes the equitable adjustment agreement, first implemented in 2000, which transfers 25,000 pounds dressed weight of halibut from the standard non-treaty allocation to the treaty Indian allocation. This transfer occurred each year for eight years (2000 through 2007). The agreement is set to expire at the end of 2007.

Washington Department of Fish and Wildlife and Oregon Department of Fish and Wildlife normally hold public meetings prior to the September Council meeting to consider changes in the halibut regulations. Any recommendations resulting from these meetings will be presented for review at the September Council meeting. The Council will take final action on proposed changes for 2008 at the November 2007 meeting.

Council Action:

1. **Adopt, for public review, any proposed changes to season structuring and the catch sharing plan for 2008.**

Reference Materials:

1. Agenda Item H.1.a, Attachment 1: 2007 Pacific Halibut Catch Sharing Plan for Area 2A.
2. Agenda Item H.1.b: Washington Department of Fish And Wildlife Report on Proposed Changes to Catch Sharing Plan and 2008 Annual Regulations.

Agenda Order:

a. Agenda Item Overview — Chuck Tracy
b. Agency and Tribal Recommendations and Comments
c. Reports and Comments of Advisory Bodies
d. Public Comment
e. **Council Action**: Adopt Proposed Changes for Public Review

PFMC
08/22/07

2007 PACIFIC HALIBUT CATCH SHARING PLAN FOR AREA 2A

(a) FRAMEWORK

This Plan constitutes a framework that shall be applied to the annual Area 2A total allowable catch (TAC) approved by the International Pacific Halibut Commission (IPHC) each January. The framework shall be implemented in both IPHC regulations and domestic regulations (implemented by NMFS) as published in the *Federal Register*.

(b) ALLOCATIONS

(1) Except as provided below under (b)(2), this Plan allocates 35 percent of the Area 2A TAC to U.S. treaty Indian tribes in the State of Washington in subarea 2A-1, and 65 percent to non-Indian fisheries in Area 2A. The allocation to non-Indian fisheries is divided into three shares, with the Washington sport fishery (north of the Columbia River) receiving 36.6 percent, the Oregon/California sport fishery receiving 31.7 percent, and the commercial fishery receiving 31.7 percent. Allocations within the non-Indian commercial and sport fisheries are described in sections (e) and (f) of this Plan. These allocations may be changed if new information becomes available that indicates a change is necessary and/or the Pacific Fishery Management Council takes action to reconsider its allocation recommendations. Such changes will be made after appropriate rulemaking is completed and published in the *Federal Register*.

(2) To meet the requirements of U.S. District Court Stipulation and Order (*U.S., et al. v. State of Washington, et al.* Case No. 9213 Phase I, Subproceeding No. 92-1, Stipulation and Order, July 7, 1999), 25,000 lb (11.3 mt) dressed weight of halibut will be transferred from the non-treaty Area 2A halibut allocation to the treaty allocation in Area 2A-1 each year for eight years commencing in the year 2000 and ending in the year 2007, for a total transfer of 200,000 lb (90.7 mt). To accelerate the total transfer, more than 25,000 lb (11.3 mt) may be transferred in any year upon prior written agreement of the parties to the stipulation.

(c) SUBQUOTAS

The allocations in this Plan are distributed as subquotas to ensure that any overage or underage by any one group will not affect achievement of an allocation set aside for another group. The specific allocative measures in the treaty Indian, non-Indian commercial, and non-Indian sport fisheries in Area 2A are described in paragraphs (d) through (f) of this Plan.

(d) TREATY INDIAN FISHERIES

Except as provided above in (b)(2), 35 percent of the Area 2A TAC is allocated to 12 treaty Indian tribes in subarea 2A-1, which includes that portion of Area 2A north of Point Chehalis, WA (46°53.30' N. lat.) and east of 125°44.00' W. long. The treaty Indian allocation is to provide for a tribal commercial fishery and a ceremonial and subsistence

fishery. These two fisheries are managed separately; any overages in the commercial fishery do not affect the ceremonial and subsistence fishery. The commercial fishery is managed to achieve an established subquota, while the ceremonial and subsistence fishery is managed for a year-round season. The tribes will estimate the ceremonial and subsistence harvest expectations in January of each year, and the remainder of the allocation will be for the tribal commercial fishery.

(1) The tribal ceremonial and subsistence fishery begins on January 1 and continues through December 31. No size or bag limits will apply to the ceremonial and subsistence fishery, except that when the tribal commercial fishery is closed, treaty Indians may take and retain not more than two halibut per day per person for subsistence purposes. Ceremonial fisheries shall be managed by tribal regulations promulgated inseason to meet the needs of specific ceremonial events. Halibut taken for ceremonial and subsistence purposes may not be offered for sale or sold.

(2) The tribal commercial fishery season dates will be set within the season dates determined by the IPHC and implemented in IPHC regulations. The tribal commercial fishery will close when the subquota is taken. Any halibut sold by treaty Indians during the commercial fishing season must comply with IPHC regulations on size limits for the non-Indian fishery.

(e) NON-INDIAN COMMERCIAL FISHERIES

The non-Indian commercial fishery is allocated 31.7 percent of the non-Indian share of the Area 2A TAC for a directed halibut fishery and an incidental catch fishery during the salmon troll fishery. The non-Indian commercial allocation is approximately 20.6 percent of the Area 2A TAC. Incidental catch of halibut in the primary directed sablefish fishery north of Point Chehalis, WA will be authorized if the Washington sport allocation exceeds 224,110 lb (101.7 mt) as described in section (e)(3) of this Plan. The structuring and management of these three fisheries is as follows.

(1) <u>Incidental halibut catch in the salmon troll fishery</u>.

Fifteen percent of the non-Indian commercial fishery allocation is allocated to the salmon troll fishery in Area 2A as an incidental catch during salmon fisheries. The quota for this incidental catch fishery is approximately 3.1 percent of the Area 2A TAC. The primary management objective for this fishery is to harvest the troll quota as an incidental catch during the May/June salmon troll fishery. The secondary management objective is to harvest the remaining troll quota as an incidental catch during the remainder of the salmon troll fishery.

(i) The Council will recommend landing restrictions at its spring public meeting each year to control the amount of halibut caught incidentally in the troll fishery. The landing restrictions will be based on the number of incidental harvest license applications submitted to the IPHC, halibut

catch rates, the amount of allocation, and other pertinent factors, and may include catch or landing ratios, landing limits, or other means to control the rate of halibut harvest. NMFS will publish the landing restrictions annually in the *Federal Register*, along with the salmon management measures.

(ii) Inseason adjustments to the incidental halibut catch fishery.

(A) NMFS may make inseason adjustments to the landing restrictions, if requested by the Council Chairman, as necessary to assure that the incidental harvest rate is appropriate for salmon and halibut availability, does not encourage target fishing on halibut, and does not increase the likelihood of exceeding the quota for this fishery. In determining whether to make such inseason adjustments, NMFS will consult with the applicable state representative(s), a representative of the Council's Salmon Advisory Sub-Panel, and Council staff.

(B) Notice and effectiveness of inseason adjustments will be made by NMFS in accordance with paragraph (f)(5) of this Plan.

(iii) If the overall quota for the non-Indian, incidental commercial troll fishery has not been harvested by salmon trollers during the May/June fishery, additional landings of halibut caught incidentally during salmon troll fisheries will be allowed in July and will continue until the amount of halibut that was initially available as quota for the troll fishery is taken or until the end of the season date for commercial halibut fishing determined by the IPHC and implemented in IPHC regulation. Landing restrictions implemented for the May/June salmon troll fishery will apply for as long as this fishery is open. Notice of the July opening of this fishery will be announced on the NMFS hotline (206) 526-6667 or (800) 662-9825. Halibut retention in the salmon troll fishery will be allowed after June only if the opening has been announced on the NMFS hotline.

(iv) A salmon troller may participate in this fishery or in the directed commercial fishery targeting halibut, but not in both.

(v) Under the Pacific Coast groundfish regulations at 50 CFR 660.383, fishing with salmon troll gear is prohibited within the Salmon Troll Yelloweye Rockfish Conservation Area (YRCA). The Salmon Troll YRCA is an area off the northern Washington coast and is defined by straight lines connecting latitude and longitude coordinates. Coordinates for the Salmon Troll YRCA are specified in groundfish regulations at 50 CFR 660.390 and in salmon regulations at 50 CFR 660.405.

(2) <u>Directed fishery targeting halibut</u>.

Eighty-five percent of the non-Indian commercial fishery allocation is allocated to the directed fishery targeting halibut (e.g., longline fishery) in southern Washington, Oregon, and California. The allocation for this directed catch fishery is approximately 17.5 percent of the Area 2A TAC. This fishery is confined to the area south of Subarea 2A-1 (south of Point Chehalis, WA; 46°53.30' N. lat.). This fishery may also be managed with closed areas designed to protect overfished groundfish species. Any such closed areas will be described annually in federal halibut regulations published in the *Federal Register* and specifically defined at 50 CFR 300.63(e). The commercial fishery opening date(s), duration, and vessel trip limits, as necessary to ensure that the quota for the non-Indian commercial fisheries is not exceeded, will be determined by the IPHC and implemented in IPHC regulations. If the IPHC determines that poundage remaining in the quota for the non-Indian commercial fisheries is insufficient to allow an additional day of directed halibut fishing, the remaining halibut will be made available for incidental catch of halibut in the fall salmon troll fisheries (independent of the incidental harvest allocation).

(3) Incidental catch in the sablefish fishery north of Point Chehalis.

If the Area 2A TAC is greater than 900,000 lb (408.2 mt), the primary directed sablefish fishery north of Point Chehalis will be allocated the Washington sport allocation that is in excess of 214,110 lb (97.1 mt), provided a minimum of 10,000 lb (4.5 mt) is available (i.e., the Washington sport allocation is 224,110 lb (101.7 mt) or greater). If the amount above 214,110 lb (97.1 mt) is less than 10,000 lb (4.5 mt), then the excess will be allocated to the Washington sport subareas according to section (f) of this Plan. The amount of halibut allocated to the sablefish fishery will be shared as follows: up to 70,000 lb of halibut to the primary sablefish fishery north of Pt. Chehalis. Any remaining allocation will be distributed to the Washington sport fishery among the four subareas according to the sharing described in the Plan, Section (f)(1).

The Council will recommend landing restrictions at its spring public meeting each year to control the amount of halibut caught incidentally in this fishery. The landing restrictions will be based on the amount of the allocation and other pertinent factors, and may include catch or landing ratios, landing limits, or other means to control the rate of halibut landings. NMFS will publish the landing restrictions annually in the Federal Register.

Under Pacific Coast groundfish regulations at 50 CFR 660.382, fishing with limited entry fixed gear is prohibited within the North Coast Commercial Yelloweye Rockfish Conservation Area (YRCA) and the Non-Trawl Rockfish Conservation Area (RCA). The North Coast Commercial Yelloweye Rockfish Conservation Area YRCA is an area off the northern Washington coast, overlapping the northern part of North Coast Recreational YRCA. The Non-Trawl RCA is an area off the Washington coast. These closed areas are defined by straight lines connecting latitude and longitude coordinates. Coordinates for

the North Coast Commercial YRCA are specified in groundfish regulations at 50 CFR 660.390. Coordinates for the Non-Trawl RCA are specified in groundfish regulations at 50 CFR 660.393.

(4) Commercial license restrictions/declarations.

Commercial fishers must choose either (1) to operate in the directed commercial fishery in Area 2A and/or retain halibut caught incidentally in the primary directed sablefish fishery north of Point Chehalis, WA or (2) to retain halibut caught incidentally during the salmon troll fishery. Commercial fishers operating in the directed halibut fishery and/or retaining halibut incidentally caught in the primary directed sablefish fishery must send their license application to the IPHC postmarked no later than April 30, or the first weekday in May, if April 30 falls on a weekend, in order to obtain a license to fish for halibut in Area 2A. Commercial fishers operating in the salmon troll fishery who seek to retain incidentally caught halibut must send their application for a license to the IPHC for the incidental catch of halibut in Area 2A postmarked no later than March 31, or the first weekday in April, if March 31 falls on a weekend. Fishing vessels licensed by IPHC to fish commercially in Area 2A are prohibited from operating in the sport fisheries in Area 2A.

(f) SPORT FISHERIES

The non-Indian sport fisheries are allocated 68.3 percent of the non-Indian share, which is approximately 44.4 percent of the Area 2A TAC. The allocation is further divided as subquotas among seven geographic subareas.

(1) Subarea management. The sport fishery is divided into seven sport fishery subareas, each having separate allocations and management measures as follows.

(i) Washington inside waters (Puget Sound) subarea.

This sport fishery subarea is allocated 23.5 percent of the first 130,845 lb (59.4 mt) allocated to the Washington sport fishery, and 32 percent of the Washington sport allocation between 130,845 lb (59.4 mt) and 224,110 lb (101.7 mt) (except as provided in section (e)(3) of this Plan). This subarea is defined as all U.S. waters east of the mouth of the Sekiu River, as defined by a line extending from 48°17.30' N. lat., 124°23.70' W. long. north to 48°24.10' N. lat., 124°23.70' W. long., including Puget Sound. The structuring objective for this subarea is to provide a stable sport fishing opportunity and maximize the season length. To that end, the Puget Sound subarea may be divided into two regions with separate seasons to achieve a fair harvest opportunity within the subarea. Due to inability to monitor the catch in this area inseason, fixed seasons, which may vary and apply to different regions within the subarea, will be established preseason based on projected catch per day and number of days to achievement of the quota. Inseason adjustments may be made, and estimates of actual catch will be made

postseason. The fishery will open in April or May and continue until a dates established preseason (and published in the sport fishery regulations) when the quota is predicted to be taken, or until September 30, whichever is earlier. The Washington Department of Fish and Wildlife will develop recommendations to NMFS on the opening date and weekly structure of the fishery each year. The daily bag limit is one fish per person, with no size limit.

(ii) Washington north coast subarea.

This sport fishery subarea is allocated 62.2 percent of the first 130,845 lb (59.4 mt) allocated to the Washington sport fishery, and 32 percent of the Washington sport allocation between 130,845 lb (59.4 mt) and 224,110 lb (101.7 mt) (except as provided in section (e)(3) of this Plan). This subarea is defined as all U.S. waters west of the mouth of the Sekiu River, as defined above in paragraph (f)(1)(i), and north of the Queets River (47°31.70' N. lat.). The management objective for this subarea is to provide a quality recreational fishing opportunity during May and the latter part of June. To meet this objective, the north coast subarea quota will be allocated as follows: 72% for the month of May and 28% for the latter part of June. The fishery will open on the first Tuesday between May 9 and 15, and continue 3 days per week (Tuesday, Thursday, and Saturday) until the May allocation is projected to be taken. The fishery will then reopen for two days on the first Tuesday and Thursday following June 17, in the following nearshore areas only:

A. WDFW Marine Catch Area 4B, which is all waters west of the Sekiu River mouth, as defined by a line extending from 48°17.30' N. lat., 124°23.70' W. long. north to 48°24.10' N. lat., 124°23.70' W. long., to the Bonilla-Tatoosh line, as defined by a line connecting the light on Tatoosh Island, WA, with the light on Bonilla Point on Vancouver Island, British Columbia (at 48°35.73' N. lat., 124°43.00' W. long.) south of the International Boundary between the U.S. and Canada (at 48°29.62' N. lat., 124°43.55' W. long.), and north of the point where that line intersects with the boundary of the U.S. territorial sea.

B. Shoreward of the recreational halibut 30-fm boundary line, a modified line approximating the 30 fm depth contour from the Bonilla-Tatoosh line south to the Queets River. Coordinates for the closed area will be specifically defined annually in federal halibut regulations published in the *Federal Register.*

The fishery will reopen for one day on the first Saturday following June 17 in the entire north coast subarea. If sufficient quota remains, the fishery would reopen, as a first priority, in the entire north coast subarea for one day on the first Thursday following June 24. If there is insufficient quota remaining to reopen the entire north coast subarea for another day, then the nearshore areas described above would reopen on the first Thursday following June 24, up to four days per

week (Thursday-Sunday), until the remaining subarea quota is projected to be taken. No sport fishing for halibut is allowed after September 30. If the fishery is closed prior to September 30, and there is insufficient quota remaining to reopen the nearshore areas for another fishing day, then any remaining quota may be transferred inseason to another Washington coastal subarea by NMFS via an update to the recreational halibut hotline. The daily bag limit in all fisheries is one halibut per person with no size limit.

Recreational fishing for groundfish and halibut is prohibited within the North Coast Recreational Yelloweye Rockfish Conservation Area (YRCA). The North Coast Recreational YRCA is a C-shaped area off the northern Washington coast and is defined by straight lines connecting latitude and longitude coordinates. Coordinates for the North Coast Recreational YRCA are specified in groundfish regulations at 50 CFR 660.390 and will be specifically defined annually in federal halibut regulations published in the *Federal Register*.

(iii) Washington south coast subarea.

This sport fishery is allocated 12.3 percent of the first 130,845 lb (59.4 mt) allocated to the Washington sport fishery, and 32 percent of the Washington sport allocation between 130,845 lb (59.4 mt) and 224,110 lb (101.7 mt) (except as provided in section (e)(3) of this Plan). This subarea is defined as waters south of the Queets River (47°31.70' N. lat.) and north of Leadbetter Point (46°38.17' N. lat.). The structuring objective for this subarea is to maximize the season length, while maintaining a quality fishing experience. The south coast subarea quota will be allocated as follows: 95% for the primary fishery, and 5% for the nearshore fishery, once the primary fishery has closed. The fishery will open on May 1. If May 1 falls on a Friday or Saturday, the fishery will open on the following Sunday. The primary fishery will be open Sunday through Thursday in all areas, except where prohibited, and the nearshore fishery will be open 7 days per week in the area from 47°25.00' N. lat. south to 46°58.00' N. lat. and east of 124°30.00' W. long. The primary fishery will continue until September 30, or until 95% of the quota is achieved, whichever is earlier. Subsequent to this closure, if there is insufficient quota remaining to reopen the primary fishery for another fishing day, then any remaining quota may be used to accommodate incidental catch in the nearshore area from 47°25.00' N. lat. south to 46°58.00' N. lat. and east of 124°30.00' W. long. on Fridays, and Saturdays, until the remaining quota is projected to be taken. If the fishery is closed prior to September 30, and there is insufficient quota remaining to reopen the nearshore areas for another fishing day, then any remaining quota may be transferred inseason to another Washington coastal subarea by NMFS via an update to the recreational halibut hotline. The daily bag limit is one halibut per person, with no size limit.

Recreational fishing for groundfish and halibut is prohibited within the South Coast Recreational YRCA. The South Coast Recreational YRCA is an area off

the southern Washington coast and is defined by straight lines connecting latitude and longitude coordinates. Coordinates for the South Coast Recreational YRCA are specified in groundfish regulations at 50 CFR 660.390 and will be specifically defined annually in federal halibut regulations published in the *Federal Register*.

(iv) Columbia River subarea.

This sport fishery subarea is allocated 2.0 percent of the first 130,845 lb (59.4 mt) allocated to the Washington sport fishery, and 4.0 percent of the Washington sport allocation between 130,845 lb (59.4 mt) and 224,110 lb (101.7 mt) (except as provided in section (e)(3) of this Plan). This subarea is also allocated 5.0 percent of the Oregon/California sport allocation or an amount equal to the contribution from the Washington sport allocation, whichever is greater. This subarea is defined as waters south of Leadbetter Point, WA (46°38.17' N. lat.) and north of Cape Falcon, OR (45°46.00' N. lat.). The fishery will open on May 1, and continue 7 days per week until 70 percent of the subarea allocation is taken or until the third Sunday in July, whichever is earlier. The fishery will reopen on the first Friday in August and continue 3 days per week, Friday-Sunday until the remainder of the subarea quota has been taken, or until September 30, whichever is earlier. Subsequent to this closure, if there is insufficient quota remaining in the Columbia River subarea for another fishing day, then any remaining quota may be transferred inseason to another Washington and/or Oregon subarea by NMFS via an update to the recreational halibut hotline. Any remaining quota would be transferred to each state in proportion to its contribution. The daily bag limit is one halibut per person, with no size limit. No groundfish may be taken and retained, possessed or landed, except sablefish and Pacific cod when allowed by groundfish regulations, if halibut are on board the vessel.

(v) Oregon central coast subarea.

This subarea extends from Cape Falcon (45°46.00' N. lat.) to Humbug Mountain, Oregon (42°40.50' N. lat.) and is allocated 92.0 percent of the Oregon/California sport allocation minus any amount of pounds needed to contribute to the Oregon portion of the Columbia River subarea quota. The structuring objectives for this subarea are to provide two periods of fishing opportunity in Spring and in Summer in productive deeper water areas along the coast, principally for charterboat and larger private boat anglers, and provide a period of fishing opportunity in the summer for nearshore waters for small boat anglers. Any poundage remaining unharvested in the Spring all-depth subquota will be added to the Summer all-depth sub-quota. Any poundage that is not needed to extend the inside 40-fathom (73 m) fishery through October 31 will be added to the Summer all-depth season if it can be used, and any poundage remaining unharvested from the Summer all-depth fishery will be added to the inside 40-fathom (73 m) fishery subquota, if it can be used. If inseason it is determined via joint consultation between IPHC, NMFS and ODFW, that the combined all-depth and inside 40-fathom (73 m) fisheries will not harvest the entire quota to the

subarea, quota may be transferred inseason to another subarea south of Leadbetter Point, WA by NMFS via an update to the recreational halibut hotline. The daily bag limit is one halibut per person, unless otherwise specified, with no size limit. During days open to all-depth halibut fishing, no groundfish may be taken and retained, possessed or landed, except sablefish when allowed by groundfish regulations, if halibut are on board the vessel.

Recreational fishing for groundfish and halibut is prohibited within the Stonewall Bank YRCA. The Stonewall Bank YRCA is an area off central Oregon, near Stonewall Bank, and is defined by straight lines connecting latitude and longitude coordinates. Coordinates for the Stonewall Bank YRCA are specified in groundfish regulations at 50 CFR 660.390 and will be specifically defined annually in federal halibut regulations published in the *Federal Register*.

ODFW will sponsor a public workshop shortly after the IPHC annual meeting to develop recommendations to NMFS on the open dates for each season each year. The three seasons for this subarea are as follows.

A. The first season opens on May 1, only in waters inside the 40-fathom (73 m) curve, and continues daily until the subquota (8 percent of the subarea quota) is taken, or until October 31, whichever is earlier. Any overage in the all-depth fisheries would not affect achievement of allocation set aside for the inside 40-fathom (73 m) curve fishery.

B. The second season is an all-depth fishery with two potential openings and is allocated 69 percent of the subarea quota. Fixed season dates will be established preseason for the first Spring opening and will not be modified inseason except if the combined Oregon all-depth Spring and Summer season total quotas are estimated to be achieved. Recent year catch rates will be used as a guideline for estimating the catch rate for the Spring fishery each year. The number of fixed season days established will be based on the projected catch per day with the intent of not exceeding the subarea subquota for this season. The first opening will be structured for 2 days per week (Friday and Saturday) if the season is for 4 or fewer fishing days. The fishery will be structured for 3 days per week (Thursday through Saturday) if the season is for 5 or more fishing days. The fixed season dates will occur in consecutive weeks starting the second Thursday in May (if the season is 5 or more fishing days) or second Friday in May (if the season is 4 or fewer fishing days), with possible exceptions to avoid adverse tidal conditions. If, following the “fixed” dates, quota for this season remains unharvested, a second opening will be held. If it is determined appropriate through joint consultation between IPHC, NMFS and ODFW, fishing may be allowed on one or more additional days. Notice of the opening(s) will be announced by NMFS via an update to the recreational halibut hotline. The fishery will be open every other week on Thursday through Saturday except that week(s) may be skipped to avoid

adverse tidal conditions. The potential open Thursdays through Saturdays will be identified preseason. The fishery will continue until there is insufficient quota for an additional day of fishing or July 31, whichever is earlier.

C. The last season is an all-depth fishery that begins on the first Friday in August and is allocated 23 percent of the subarea quota. The fishery will be structured to be open every other week on Friday through Sunday except that week(s) may be skipped to avoid adverse tidal conditions. The fishery will continue until there is insufficient quota remaining to reopen for another fishing day or October 31, whichever is earlier. The potential open Fridays through Sundays will be identified preseason. If after the first scheduled open period, the remaining Cape Falcon to Humbug Mountain entire season quota (combined all-depth and inside 40-fathom (73 m) quotas) is 60,000 lb (27.2 mt) or more, the fishery will re-open on every Friday through Sunday (versus every other Friday through Sunday), if determined to be appropriate through joint consultation between IPHC, NMFS, and ODFW. The inseason action will be announced by NMFS via an update to the recreational halibut hotline. If after the Labor Day weekend, the remaining Cape Falcon to Humbug Mountain entire season quota (combined all-depth and inside 40-fathom (73 m) quotas) is 30,000 lb (13.6 mt) or more and the fishery is not already open every Friday through Sunday, the fishery will re-open on every Friday through Sunday (versus every other Friday through Sunday), if determined to be appropriate through joint consultation between IPHC, NMFS, and ODFW. After the Labor Day weekend, the IPHC, NMFS, and ODFW will consult to determine whether increasing the Oregon Central Coast bag limit to two fish is warranted with the intent that the quota for the subarea is taken by September 30. If the quota is not taken by September 30, the season will remain open, maintaining the bag limit in effect at that time, through October 31 or quota attainment, whichever is earlier. The inseason action will be announced by NMFS via an update to the recreational halibut hotline.

(vi) South of Humbug Mountain subarea.

This sport fishery subarea is allocated 3.0 percent of the Oregon/California subquota, which is approximately 0.62 percent of the Area 2A TAC. This area is defined as the area south of Humbug Mountain, OR (42°40.50' N. lat.), including California waters. The structuring objective for this subarea is to provide anglers the opportunity to fish in a continuous, fixed season that is open from May 1 through October 31. The daily bag limit is one halibut per person, with no size limit. Due to inability to monitor the catch in this area inseason, a fixed season will be established preseason by NMFS based on projected catch per day and number of days to achievement of the subquota; no inseason adjustments will be made, and estimates of actual catch will be made post season.

(2) Port of landing management. All sport fishing in Area 2A will be managed on a "port of landing" basis, whereby any halibut landed into a port will count toward the quota for the subarea in which that port is located, and the regulations governing the subarea of landing apply, regardless of the specific area of catch.

(3) Possession limits. The sport possession limit on land in Washington is two daily bag limits, regardless of condition, but only one daily bag limit may be possessed on the vessel. The sport possession limit on land in Oregon is three daily bag limits, regardless of condition, but only one daily bag limit may be possessed on the vessel. The sport possession limit on land in California and on the vessel is one daily bag limit, regardless of condition.

(4) Ban on sport vessels in the commercial fishery. Vessels operating in the sport fishery for halibut in Area 2A are prohibited from operating in the commercial halibut fishery in Area 2A. Sport fishers and charterboat operators must determine, prior to May 1 of each year, whether they will operate in the commercial halibut fisheries in Area 2A which requires a commercial fishing license from the IPHC. Sport fishing for halibut in Area 2A is prohibited from a vessel licensed to fish commercially for halibut in Area 2A.

(5) Flexible inseason management provisions.

(i) The Regional Administrator, NMFS Northwest Region, after consultation with the Chairman of the Pacific Fishery Management Council, the IPHC Executive Director, and the Fisheries Director(s) of the affected state(s), or their designees, is authorized to modify regulations during the season after making the following determinations.

(A) The action is necessary to allow allocation objectives to be met.

(B) The action will not result in exceeding the catch limit for the area.

(C) If any of the sport fishery subareas north of Cape Falcon, OR are not projected to utilize their respective quotas by September 30, NMFS may take inseason action to transfer any projected unused quota to another Washington sport subarea.

(D) If any of the sport fishery subareas south of Leadbetter Point, WA are not projected to utilize their respective quotas by their season ending dates, NMFS may take inseason action to transfer any projected unused quota to another Oregon sport subarea.

(ii) Flexible inseason management provisions include, but are not limited to, the following:

(A) Modification of sport fishing periods;

(B) Modification of sport fishing bag limits;

(C) Modification of sport fishing size limits;

(D) Modification of sport fishing days per calendar week; and

(E) Modification of subarea quotas north of Cape Falcon, OR.

(iii) Notice procedures.

(A) Inseason actions taken by NMFS will be published in the *Federal Register*.

(B) Actual notice of inseason management actions will be provided by a telephone hotline administered by the Northwest Region, NMFS, at 206-526-6667 or 800-662-9825 (May through October) and by U.S. Coast Guard broadcasts. These broadcasts are announced on Channel 16 VHF-FM and 2182 kHz at frequent intervals. The announcements designate the channel or frequency over which the notice to mariners will be immediately broadcast. Since provisions of these regulations may be altered by inseason actions, sport fishermen should monitor either the telephone hotline or U.S. Coast Guard broadcasts for current information for the area in which they are fishing.

(iv) Effective dates.

(A) Inseason actions will be effective on the date specified in the Federal Register notice or at the time that the action is filed for public inspection with the Office of the Federal Register, whichever is later.

(B) If time allows, NMFS will invite public comment prior to the effective date of any inseason action filed with the *Federal Register*. If the Regional Administrator determines, for good cause, that an inseason action must be filed without affording a prior opportunity for public comment, public comments will be received for a period of 15 days after of the action in the *Federal Register*.

(C) Inseason actions will remain in effect until the stated expiration date or until rescinded, modified, or superseded. However, no inseason action has any effect beyond the end of the calendar year in which it is issued.

(v) Availability of data. The Regional Administrator will compile, in aggregate form, all data and other information relevant to the action being taken and will make them available for public review during normal office hours at the Northwest Regional Office, NMFS, Sustainable Fisheries Division, 7600 Sand Point Way NE, Seattle, WA.

(6) Sport fishery closure provisions.

The IPHC shall determine and announce closing dates to the public for any subarea in which a subquota is estimated to have been taken. When the IPHC has determined that a subquota has been taken, and has announced a date on which the season will close, no person shall sport fish for halibut in that area after that date for the rest of the year, unless a reopening of that area for sport halibut fishing is scheduled by NMFS as an inseason action, or announced by the IPHC.

(g) PROCEDURES FOR IMPLEMENTATION

Each year, NMFS will publish a proposed rule with any regulatory modifications necessary to implement the Plan for the following year, with a request for public comments. The comment period will extend until after the IPHC annual meeting, so that the public will have the opportunity to consider the final Area 2A TAC before submitting comments. After the Area 2A TAC is known, and after NMFS reviews public comments, NMFS will implement final rules governing the sport fisheries. The final ratio of halibut to chinook to be allowed as incidental catch in the salmon troll fishery will be published with the annual salmon management measures.

Sources:
72 FR 11792 (March 14, 2007)
71 FR 10850 (March 3, 2006)
70 FR 20304 (April 19, 2005)
69 FR 24524 (May 4, 2004)
68 FR 10989 (March 7, 2003)
67 FR 12885 (March 20, 2002)
66 FR 15801 (March 21, 2001)
65 FR 14909 (March 20, 2000)
64 FR 13519 (March 19, 1999)
63 FR 13000 (March 17, 1998)
62 FR 12759 (March 18 , 1997)
61 FR 11337 (March 20, 1996)
60 FR 14651 (March 20, 1995)
59 FR 22522 (May 2, 1994)
58 FR 17791 (April 6, 1993)

NMFS PROPOSED CHANGES TO THE 2008 PACIFIC HALIBUT CATCH SHARING PLAN FOR AREA 2A

NMFS is proposing a few editorial changes to the 2008 Pacific halibut Catch Sharing Plan (CSP) to clean up some outdated language. The proposed changes are as follows:

1) In section (b) Allocations, delete paragraph (b)(2) referring to the 25,000 lb tribal allocation resulting from the U.S. v. Washington case (U.S., et al. v. State of Washington, et al. Case No. 9213 Phase I, Subproceeding No. 92-1, Stipulation and Order, July 7, 1999). This paragraph required 25,000 lb dressed weight of halibut to be transferred from the non-treaty Area 2A halibut allocation to the treaty allocation in Area 2A-1 each year for eight years from 2000-2007, for a total transfer of 200,000 lb. Because this total transfer of 200,000 pounds is complete, this language is no longer necessary in the CSP. In addition, language referring to paragraph (b)(2) is deleted from paragraphs (b)(1) and (d) of the CSP.

2) In section (f) and in paragraph (f)(1), the number of sport subareas is revised from seven to six. In 2004, the Oregon Central Coast, previously two subareas- North Central and South Central, joined into one Central Coast subarea. Since 2004, there have been six sport subareas instead of seven.

3) In section (f)(5)(ii)(E) of the CSP and in 50 CFR 300.63 (c)(2)(v) of the regulations, flexible inseason management for sport fisheries, the phrase “north of Cape Falcon, OR” is removed from the phrase so that it reads, “modification of subarea quotas.” As mentioned in the paragraph (f)(5)(i)(C) and (D), unused quota can be moved inseason both north of Cape Falcon, OR, and south of Leadbetter Point, WA, to modify quota in Area 2A sport fisheries.

WASHINGTON DEPARTMENT OF FISH AND WILDLIFE REPORT ON PROPOSED CHANGES TO CATCH SHARING PLAN AND 2008 ANNUAL REGULATIONS

The Washington Department of Fish and Wildlife (WDFW) held a recreational halibut meeting to develop and consider proposed changes to the Pacific Fishery Management Council's catch sharing plan for 2008, in Montesano, on August 14, 2007.

Based on the public input we received, we would support the following changes to the 2008 Pacific Halibut Catch Sharing Plan for Area 2A, section (f) SPORT FISHERIES, be approved for public review, in addition to the status quo alternative. Suggested revisions to the Catch Sharing Plan language to incorporate the changes are provided on page 3.

Washington North Coast Subarea

1. **For the June fishery, implement the following changes: a) revise the opening date to the first Tuesday following June 16; b) specify that the Saturday offshore opener is contingent upon available quota; and c) provide flexibility in the date that the late June fishery reopens.**

   Rationale – a) For ease of sampling the recreational halibut fishery, it would be beneficial if the halibut season did not overlap with the salmon season, which typically begins around July 1 in this area. With the current opening day scheduled as the first Tuesday following June 17, in 2008, the fishery would open on June 24 (as the 17th is a Tuesday); this could easily result in the fishery extending beyond June 30, which could conflict with the salmon season. By changing the date to June 16, the fishery could open as early as June 17, or as late as June 23.

   b) This is more of a "housekeeping" measure. We do not anticipate that the fishery would be open unless it had been determined that there was sufficient quota remaining beforehand; however, adding this language clarifies that understanding.

   c) The current Catch Sharing Plan specifies that, if sufficient quota remains, the fishery will reopen on the first Thursday following June 24. However, given our catch accounting system, we will not have the data for the first June opener available until the following Tuesday or Wednesday, which does not provide much notice to the public. This proposal would retain the June 24 date, but allow the fishery to reopen on any day following that date, rather than specify the "first Thursday."

Washington South Coast Subarea

2. **For the primary season, implement the following changes: a) in 2008, retain the opening date of May 1. Beginning in 2009, open the fishery on May 1, if it is a Sunday; otherwise, open on the first Sunday following May 1; and b) specify that the fishery will be open two days per week—Sunday and Monday.**

   Rationale – a) In 2008, May 1 falls on a Thursday; however, several charterboats have already booked trips for May 1, 2008, as the traditional opening date. Therefore, changing the opening date now would result in cancelling and/or rescheduling of those trips, which may be difficult to do, especially as subsequent open days are also rapidly filling up. This would provide the fishery with advance notice of changing the opening date, beginning in 2009, to align with the days of the week that the fishery would be open (i.e., Sunday and Monday).

   b) The south coast halibut season in 2007 lasted six days and, because the fishery was open five days per week, we had to close the fishery with only a 24-hour notice. Anglers were already in port or on their way by the time they received the notice. Reducing the number of days per week that the fishery will be open from five to two would provide more time between openings, during which the catch could be tallied and a reopening scheduled.

3. **For the nearshore fishery, implement the following changes: a) revise the set aside to 10% or 15% of the South Coast quota, which would be used to provide a northern nearshore fishery after the offshore fishery has closed; and b) specify that the nearshore-only fishery would be open on Fridays and Saturdays, even during the primary season.**

   Rationale – a) For the past three years (2005-07), the South Coast fishery has exceeded its quota during the primary season thereby precluding the northern nearshore area from reopening. In the past, the northern nearshore area has either remained open or reopened following the offshore closure; this allows anglers to keep halibut incidentally caught while targeting bottomfish or salmon in the nearshore area. The northern nearshore area does not contain any known halibut "hot spots," so the catch rate in this area is low, which allows us to monitor catches against fairly small amounts of remaining quota. A 5% set aside was implemented in 2007; however, higher than anticipated catches and a higher average weight resulted in the entire quota being taken in the primary fishery. A higher set aside of 10% or 15% could provide greater insurance (i.e., a "buffer") against this.

   b) When the primary season was open five days per week, there were only two days per week that the nearshore fishery was open with the offshore area closed (Friday and Saturday). With the revised primary season days (Sunday and Monday), it could be more difficult to monitor nearshore fishing activity. This change would keep the nearshore area open on days that the offshore is open and on Fridays and Saturdays (open Friday-Monday, closed Tuesday-Thursday).

WDFW SUGGESTED CATCH SHARING PLAN LANGUAGE CHANGES

Modify the language in Section (f) SPORT FISHERIES as follows:

(ii) Washington north coast subarea.

"This sport fishery subarea is allocated…until the May allocation is projected to be taken. The fishery will reopen for two days on the first Tuesday and Thursday following June ~~17~~ **16**, in the following nearshore areas only…**If there is sufficient quota,** the fishery will reopen for one day on the first Saturday following June ~~17~~ **16** in the entire north coast subarea. If sufficient quota remains, the fishery would reopen, as a first priority, in the entire north coast subarea for one day ~~on the first Thursday~~ following June 24. If there is insufficient quota remaining to reopen the entire north coast subarea for another day, then the nearshore areas described above would reopen ~~on the first Thursday~~ following June 24, up to four days per week (Thursday-Sunday), until the remaining subarea quota is projected to be taken…."

(iii) Washington south coast subarea.

"…The structuring objective for this subarea is to maximize season length, while maintaining a quality fishing experience. The south coast subarea quota will be allocated as follows: 95% **(or 90% or 85%)** for the primary fishery, and 5% **(or 10% or 15%)** for the nearshore fishery, once the primary fishery has closed. **In 2008,** the fishery will open on May 1. ~~If May 1 falls on a Friday or Saturday~~ **Beginning in 2009**, the fishery will open **on May 1, if it is a Sunday; otherwise, the fishery will open on the first Sunday** following ~~Sunday~~ **May 1**. The primary fishery will be open **two days per week,** Sunday ~~through Thursday~~ **and Monday,** in all areas, except where prohibited, and the nearshore fishery will be ~~open 7 days per week~~ **closed on Tuesday, Wednesday, and Thursday**…."

Agenda Item H.1.c
Supplemental GAP Report
September 2007

GROUNDFISH ADVISORY SUBPANEL REPORT ON PROPOSED CHANGES TO CATCH SHARING PLAN AND 2008 ANNUAL REGULATIONS

The Groundfish Advisory Subpanel (GAP) was given a report and reviewed the proposed Washington Sport halibut regulatory changes presented by Michele Culver. The GAP supports the changes proposed by the State of Washington go forward for public review without objection.

The State of Oregon did not propose any changes to its current regulations.

PFMC
09/14/07

PACIFIC HALIBUT BYCATCH ESTIMATE FOR INTERNATIONAL PACIFIC HALIBUT COMMISSION (IPHC) ADOPTION

Mr. John Wallace, National Marine Fisheries Service (NMFS), will brief the Council on the status of bycatch estimates for Pacific halibut in the Council-area groundfish trawl fishery.

The halibut bycatch estimates for the 2006 groundfish trawl fishery in IPHC Area 2A waters include information from the groundfish observer program and effects of the groundfish area closures in 2006. A supplemental report was provided to the Scientific and Statistical Committee (SSC) for review with the intent of providing estimates to the IPHC to use in establishing the 2008 halibut fisheries (Agenda Item H.2.b, Supplemental NMFS Report).

Council Task:

Utilizing input from the SSC, provide any needed Council guidance to the completion of the bycatch assessment and its transmittal to the IPHC.

Reference Materials:

1. Agenda Item H.2.b, Supplemental NMFS Report: Pacific Halibut Bycatch in IPHC Area 2A in 2006.

Agenda Order:

a. Agenda Item Overview	Chuck Tracy
b. NMFS Report	John Wallace
c. Reports and Comments of Advisory Bodies	
d. Public Comment	
e. Council Review and Guidance	

PFMC
08/20/07

Pacific Halibut Bycatch in IPHC Area 2A in the 2006 Groundfish Trawl Fishery

John Wallace
Jim Hastie

NOAA Fisheries
Northwest Fisheries Science Center
Seattle, WA

September 2007

ABSTRACT

This report updates the estimates of Pacific halibut bycatch and mortality in the bottom trawl fishery through the calendar year 2006. The estimates of halibut bycatch and mortality in the bottom trawl fishery are based upon the method developed in the report for 1999 (Wallace, 2000). The current report uses halibut bycatch rates observed for the 2006 calendar year by the West Coast Groundfish Observer Program. These rates are stratified by season, depth, latitude, and amount of arrowtooth flounder catch, and then multiplied by the amount of 2006 trawl effort in each stratum determined from Oregon and Washington trawl logbooks. Estimated halibut bycatch and mortality from other gear types has not been updated for 2006. The estimate for the 2006 bottom trawl fishery is 333,000 lb net weight of total halibut bycatch mortality, of which 252,000 lb is legal-sized. The net weight is 7 percent lower than in 2005. As in past reports, forecast of bycatch for the current year (2007) or future years is not attempted.

GROUNDFISH FISHERY BACKGROUND

Changes in the groundfish fishery and its management affect not only the amount of groundfish fishing effort, but also its geographic and temporal distribution. Since halibut bycatch rates vary among time and area strata, changes in the amount and distribution of effort will alter the amount of halibut bycatch that is estimated for the trawl fleet. Here we briefly describe the management changes that occurred in 2006.

During 2006, the trawl fishery north of 40°10' N. Lat. continued to be managed with use of the Rockfish Conservation Area (RCA), and the requirement that selective flatfish gear be used for fishing shoreward of the closed area. There were two noteworthy differences in the configuration of the RCA between 2005 and 2006. In 2005, the shoreward boundary of the RAC was set at the line approximating 100 fm from March through September. For this period in 2006, the shoreward boundary was set at the line approximating 75 fm, with the exception of July and August, where the boundary was at 100 fm. During October to December of 2005, the entire area shoreward of the 250 fm line was closed to bottom trawling, however, in 2006 the shoreward boundary of the RCA continued at 75 fm throughout the end of the year and designated petrale areas between 150 and 250 fm were open. Consequently less area was open to fishing in 2006 prior to October, but considerably more area from October on. This change is reflected in the fact that the number of hours trawled shoreward of the RCA in 2006 fell by roughly 1,200 from the start of the year through August, but increased by about 1,600 from September through December. Trawling seaward of the RCA increased by roughly 2,800 hours in 2006, primarily due to the availability of the petrale areas in November and December.

Near-shore trip limits for petrale and Dover soles, as well as sablefish, were somewhat lower in 2006, except at the end of the year, when the 2005 fishery was closed shoreward of 2005 fm. Most deep-water limits, as well as near-shore limits for other flatfish were generally comparable between the two years..

2006 BYCATCH ESTIMATES

Analysis of 2006 data from the West Coast Groundfish Observer Program

The WCGOP provided data for the complete calendar year of 2006 for this assessment. There were 2,327 bottom trawl tows between 48.667 and 40.667 degrees N. latitude included in this study (Figure 1). An estimated net total weight of 152,942 lb of halibut was caught in those tows. Eighty percent of these weights are estimated by using the Pacific halibut length-weight relationship (IPHC, personal communication), four percent are from actually weighing the fish, seven percent are from visual estimates, and the remaining nine percent is from other methods. The length frequencies of the halibut measured in the 2006 observer data are given in Table 1.

For all of the Limited-Entry groundfish trawl activity, methods similar to those in Pikitch (1998) were used to analyze the observer data and identify appropriate strata for bycatch estimation. These strata are season (Jan-Aug and Sept-Dec), depth (0-75, 75-150 150-250, 250-700 fm), area (four latitude ranges) and catch of arrowtooth flounder (0-20 lb/hour and >20 lb/hour). Numbers

of tows, halibut catches, halibut catch rates, and the proportions of legal-sized halibut (>81 cm) are listed for each of these strata in Table 2.

Bottom Trawl Effort from Logbooks

Logbook data for Oregon and Washington in 2006 were obtained from PacFIN. Since ODFW does not collect logbook data for 100 percent of the trawl deliveries during a typical year, Oregon logbook effort (hours towed) was expanded using fish tickets on a port and month basis. This approach was used in order to avoid any potential bias created by unequal collection of logbooks in the three major ports (Astoria, Newport, and Coos Bay). For Washington trips, WDFW's "extrapolated and expanded" trawl effort for 2006 had problems which were not rectified in time for this report; hence raw haul duration was adjusted, by strata, using the same proportional adjustments as seen in 2005.

Logbook trawl effort (hours) for Oregon was expanded to that entire fleet using the ratio of total groundfish catch reported on fish tickets divided by logbook groundfish catch, for each port and month. These expansion ratios were applied to the tow effort (hours) to arrive at the expanded effort for Oregon's trawl fleet. The stratification scheme identified through analysis of observer data was then applied to the expanded logbook effort observations. Total fleet effort for each stratum in 2006 is reported in Table 2.

Halibut bycatch in each stratum was estimated by multiplying total (expanded) stratum effort by the stratum halibut bycatch rate. Bycatch by the bottom trawl fleet is estimated by summing across strata. If there was effort within a stratum, but no observer tows, the coast-wide average bycatch rate (14.39 kg per hour) was used. This value is calculated as the unweighted average of the stratum means. Preliminary work done in 2001 using a sophisticated approach of imputing missing data showed little difference, on the calculated total bycatch, between using the unweighted average of the stratum means and the imputed values.

Results

As in earlier years, half of the released halibut are assumed to survive capture (Gregg Williams, IPHC, personal communication). Therefore, discard mortality of halibut is assumed to be 50 percent of total discard. The proportion of legal-sized halibut (> 81cm) is estimated from the length frequencies of halibut measured in the observer data (Table 1). All measurements of fish lengths were converted to fish weight based on a length-weight relationship for Pacific halibut, and the proportion of legal-sized fish (by weight) was computed for each stratum (Table 2). The average proportion legal (73.13% by weight, calculated as the unweighted average of the stratum means) was used when no other estimate was available.

For comparison purposes, 2006 totals are shown together with annual totals since 1998 in Table 3. The 95% confidence limits, based on the variability in discard of halibut per trawl hour, are given in parentheses. Note that the trawl effort is assumed known without error; hence these confidence limits are a minimum estimate. All estimates from 2002 forward incorporate

observation data collected by the WCGOP. Total estimated discard mortality of halibut decreased by 7% between 2005 and 2006, despite an increase in overall trawl effort of 8.2 percent. Trawl effort in depths less than 150 fm, where halibut bycatch rates are generally higher, increased by only 2% (Table 4). The estimated mortality of halibut at 7.8 lb/hour is the second lowest seen since 1998. Estimated mortalities of 'all' and of 'legal-sized' halibut since 1977 are listed in Tables 5 and 6, respectively. The percentage of discard comprised by legal-sized fish (0.7544) was the second highest value in the time series, eclipsed only by the high seen in 2003. However, the total amount of halibut mortality in 2006 was the second lowest amount estimated over the past decade. Halibut discard was more evenly distributed among strata in 2006, with only 33% of the estimated discard of legal-sized fish occurred in highest eight (out of 64) strata included in the analysis. In 2005, the same eight strata accounted for 58% of the estimated discard of legal-sized fish.

It is not possible to make a forecast for the 2007 fishery given lack of a methodology to project the distribution of effort among model strata prior to the complete availability of a year's logbook data.

REFERENCES

Pikitch, E.K., Wallace, J.R., Babcock, E.A., Erickson, D.L., Saelens, M., and Oddsson, G. (1998) Pacific halibut bycatch in the Washington, Oregon, and California groundfish and shrimp trawl fisheries. North American Journal of Fisheries Management. Volume 18, pp. 569-586.

Wallace, J.R. (2000) Unpublished report. Pacific halibut discard in the EDCP Observer Program. June 2000. 18 pg.

Williams, G. H., G. Stauffer, H. Weeks, M. Saelens, J. Scordino, D. Bodenmiller, and T. Northup (1998). Pacific halibut bycatch in Area 2A: Bycatch rates and current estimates of bycatch mortality. Int. Pac. Halibut Comm. Rep. of Assess. and Res. Activ. 1998: 269-282.

Table 1. Length frequencies for Pacific halibut from the West Coast Groundfish Observer Program data. (The upper limits on the length intervals are inclusive, the lower limits are not.)

Length Interval (cm)	Length Freq.	Percent Length Freq.
25-30	0	0.00
30-35	0	0.00
35-40	1	0.03
40-45	2	0.07
45-50	7	0.23
50-55	27	0.88
55-60	181	5.92
60-65	512	16.74
65-70	636	20.79
70-75	522	17.06
75-80	416	13.60
80-85	258	8.43
85-90	165	5.39
90-95	111	3.63
95-100	72	2.35
100-105	48	1.57
105-110	43	1.41
110-115	23	0.75
115-120	9	0.29
120-125	8	0.26
125-130	7	0.23
130-135	5	0.16
135-140	5	0.16
140-145	0	0.00
145-150	0	0.00
150-155	1	0.03
155-160	0	0.00
160-165	0	0.00
165-170	0	0.00
170-175	0	0.00
175-180	0	0.00
180-185	0	0.00
Total	3059	100

Table 2. Numbers of tows, halibut catches, halibut catch rates and effort, by strata, observed in the bottom trawl fishery by the West Coast Groundfish Observer Program. The last two columns, from 2005, are for comparison purposes. (The upper limits are inclusive for all intervals; the lower limits are not.)

SEASON: JANUARY - AUGUST

Arrowtooth Catch (lb/h)	Latitude	Depth (Fathoms)	Number of Observed Tows	Number of Tows with ≥ 1 Halibut	Wgt. (kg., rnd) Halibut per Hour	Trawl Effort (hours) from OR & WA	Proportion Legal by Weight	Number of Observed Tows 2005	Wgt. (kg., rnd) Halibut per Hour 2005
≤ 20	40.667 - 42.667	0 - 75	0	0		264.41		0	
		75 - 150	0	0		1.01		0	
		150 - 250	9	4	3.84	439.90		2	0.00
		250 - 700	50	2	0.07	984.64	0.73	17	0.07
	42.667 - 46.667	0 - 75	402	196	10.59	4158.95	0.76	316	5.83
		75 - 150	62	22	7.90	730.63	0.74	95	5.59
		150 - 250	71	18	1.83	1814.13	0.62	65	2.70
		250 - 700	137	5	0.14	3596.86	0.86	152	0.27
	46.667 - 47.667	0 - 75	155	96	10.73	2092.30	0.81	294	5.35
		75 - 150	4	3	1.89	87.86		21	37.24
		150 - 250	6	4	1.63	141.35		26	6.04
		250 - 700	27	3	0.25	698.48		31	1.95
	47.667 - 48.667	0 - 75	146	114	36.88	1567.38	0.71	157	71.00
		75 - 150	18	13	22.33	198.58	0.34	197	48.45
		150 - 250	24	11	5.16	531.80		36	40.18
		250 - 700	34	1	0.18	923.44	0.55	22	0.07
> 20	40.667 - 42.667	0 - 75	0	0		1.75		0	
		75 - 150	0	0		1.07		0	
		150 - 250	0	0		94.88		9	5.56
		250 - 700	3	0	0.00	73.62		6	0.00
	42.667 - 46.667	0 - 75	144	90	12.82	2239.27	0.76	152	6.71
		75 - 150	83	54	13.63	919.49	0.46	119	24.04
		150 - 250	164	78	3.17	2544.76	0.57	211	4.90
		250 - 700	61	15	1.62	1174.68	0.69	126	2.40
	46.667 - 47.667	0 - 75	38	29	11.25	889.50		52	8.61
		75 - 150	9	6	12.32	155.24	0.85	11	16.67
		150 - 250	15	11	5.57	350.18	0.70	30	4.14
		250 - 700	4	1	0.48	103.60		16	6.74
	47.667 - 48.667	0 - 75	54	54	51.79	592.23	0.87	79	46.04
		75 - 150	36	25	44.26	306.44	0.96	97	23.49
		150 - 250	21	16	27.57	419.78	1.00	23	7.99
		250 - 700	22	16	8.83	383.56	0.65	23	15.61

Table 2. Continued.

SEASON: SEPTEMBER - DECEMBER

Arrowtooth Catch (lb/h)	Latitude	Depth (Fathoms)	Number of Observed Tows	Number of Tows with ≥ 1 Halibut	Wgt. (kg., rnd) Halibut per Hour	Trawl Effort (hours) from OR & WA	Proportion Legal by Weight	Number of Observed Tows 2005	Wgt. (kg., rnd) Halibut per Hour 2005
≤ 20	40.667 - 42.667	0 - 75	0	0		85.88		0	
		75 - 150	0	0		0.00		0	
		150 - 250	5	2	1.25	315.84		0	
		250 - 700	8	1	0.91	532.23		30	0.02
	42.667 - 46.667	0 - 75	123	15	0.36	2149.03		16	5.06
		75 - 150	4	0	0.00	48.88		8	0.50
		150 - 250	8	3	5.03	707.17		12	23.79
		250 - 700	69	4	0.11	2575.73	0.77	57	0.10
	46.667 - 47.667	0 - 75	12	2	0.23	519.86		27	2.06
		75 - 150	0	0		0.00		1	2.91
		150 - 250	1	0	0.00	91.07		1	0.00
		250 - 700	1	1	0.97	193.14		9	0.00
	47.667 - 48.667	0 - 75	41	37	61.49	615.54		14	64.18
		75 - 150	6	2	75.05	74.31		7	3.42
		150 - 250	0	0	14.39	167.39		1	14.70
		250 - 700	6	3	0.81	511.73		23	2.40
> 20	40.667 - 42.667	0 - 75	0	0		2.47		0	
		75 - 150	0	0		0.00		0	
		150 - 250	0	0		37.12		1	2.66
		250 - 700	1	1	1.73	57.37		5	0.00
	42.667 - 46.667	0 - 75	76	16	0.74	1530.04		24	2.41
		75 - 150	10	2	0.49	72.63		52	8.83
		150 - 250	67	46	9.11	1603.51	0.95	22	8.50
		250 - 700	39	9	0.42	1333.55		22	1.92
	46.667 - 47.667	0 - 75	7	1	0.59	180.05		0	
		75 - 150	0	0		0.00		0	
		150 - 250	1	1	4.36	21.90		3	0.53
		250 - 700	0	0		35.21		2	0.00
	47.667 - 48.667	0 - 75	6	5	226.20	231.14		11	12.75
		75 - 150	25	2	0.71	114.91		13	9.43
		150 - 250	8	8	28.96	221.98		0	
		250 - 700	4	3	3.14	91.00		3	5.44

Table 3. Halibut bycatch and mortality in the Oregon and Washington bottom trawl fisheries for groundfish off the west coast. Estimates from 2002 forward are based on observations by the West Coast Groundfish Observer Program. All estimates in this table (except the seventh and last column) are derived from a sum over strata cells; see the text for details. The 95% confidence limits, based on the variability in discard of halibut per trawl hour, are given in parentheses. Note that the trawl effort is assumed known without error; hence these confidence limits are a minimum estimate.

Year	Trawl Effort (hours)	Estimated Halibut Bycatch (numbers)	Estimated Halibut Bycatch (kg, round)	Estimated Halibut Bycatch (lb, net)	Estimated Total Halibut Mortality (lb, net)	Est. Mortal-ity (lb) per Trawl Hour	Estimate d Legal-Sized Halibut Mortality (lb, net)	Estimated Legal-Sized divided by Total Halibut Mortality
1998	92,294	164,961	1,259,374	2,082,690	1,041,345	11.3	691,755	0.6643
1999	81,420	147,995	1,144,236	1,892,280	946,140	11.6	638,091	0.6744
2000	70,363	122,234	944,120	1,561,338	780,669	11.1	523,097	0.6701
2001	67,199	124,969	962,348	1,591,482	795,741	11.8	532,912	0.6697
2002	52,168	NA	618,913	1,023,527	511,764	9.8	286,221	0.5593
2003	58,339	NA	558,544	923,693	461,847	7.9	366,745	0.7941
2004	37,495	NA	296,225	489,882	244,941	6.5	171,754	0.7012
2005	39,377	NA	432,806	715,752	357,876	9.1	228,049	0.6372
2006	42,602	NA	403,194 (163k-688k)	666,782 (269k-1,137k)	333,391 (134k-569k)	7.8	251,507 (99k-430k)	0.7544

Note: Halibut bycatch by California bottom trawl fishery is not included. Mortality estimated at 50% of bycatch. Proportion of legal-sized mortality (>81 cm) estimated from length frequencies of fish measured by the West Coast Groundfish Observer Program. 1 kg, round = 1.65375 pounds, net weight.

Table 4. Trawl effort (hours) in the 2005 and 2006 bottom trawl fisheries off Oregon and Washington.

Arrowtooth Catch (lb/h)	Latitude	Depth (fathoms)	Trawl effort (hours)		% change from 2005 to 2006
			2005	2006	
≤ 20	40.667 - 42.667	0 - 150	171	351	105%
		150 - 700	1,741	2,273	31%
	42.667 - 46.667	0 - 150	6,724	7,087	5%
		150 - 700	6,629	8,694	31%
	46.667 - 47.667	0 - 150	2,220	2,700	22%
		150 - 700	1,318	1,124	-15%
	47.667 - 48.667	0 - 150	3,325	2,456	-26%
		150 - 700	1,603	2,134	33%
	Total	0 - 150	12,441	12,595	1%
		150 - 700	11,292	14,225	26%
		All depths	23,733	26,820	13%
> 20	40.667 - 42.667	0 - 150	1	5	400%
		150 - 700	537	263	-51%
	42.667 - 46.667	0 - 150	4,303	4,761	11%
		150 - 700	6,569	6,657	1%
	46.667 - 47.667	0 - 150	777	1,225	58%
		150 - 700	633	511	-19%
	47.667 - 48.667	0 - 150	1,905	1,245	-35%
		150 - 700	920	1,116	21%
	Total	0 - 150	6,986	7,236	4%
		150 - 700	8,659	8,547	-1%
		All depths	15,644	15,783	1%
Total	Total	0 - 150	19,427	19,831	2%
		150 - 700	19,950	22,772	14%
		All depths	39,377	42,602	8%

Table 5. Summary of total estimated bycatch mortality of Pacific halibut, in thousands of pounds, net weight, by fishery in 2A. Bycatch mortality estimates for 1977-1997 are reported from Table 3 in Williams, et al. 1998.

Year	Foreign, JV & Catcher-Proc.	Groundfish Trawls	Shrimp Trawls	Hook & Line	TOTAL
1977	3	308	82	16	409
1978	2	308	82	16	408
1979	1	308	82	16	407
1980	1	308	82	16	407
1981	Trace	308	82	16	406
1982	Trace	308	82	16	406
1983	1	308	82	16	407
1984	Trace	308	82	16	406
1985	Trace	308	82	16	406
1986	1	308	82	16	407
1987	1	308	82	16	407
1988	1	308	82	16	407
1989	2	308	82	16	408
1990	2	308	82	16	408
1991	2	308	82	16	408
1992	0	385	43	16	444
1993	0	385	43	16	444
1994	0	385	43	16	444
1995	0	548	50	16	614
1996	0	548	50	16	614
1997	0	548	50	16	614
1998	0	1,041	25	---	---
1999	---	946	---	---	---
2000	---	781	---	---	---
2001	---	796	---	---	---
2002	---	512	---	---	---
2003	---	462	---	---	---
2004	---	245	---	---	---
2005	---	358	---	---	---
2006	---	333	---	---	---

Note: Bycatch mortality by groundfish trawls in 1998-2004 does not include fisheries off California. Bycatch mortality by shrimp trawls in 1998 does not include fisheries off California and Washington.

Table 6. Summary of estimated mortality of legal-sized Pacific halibut, in thousands of pounds, net weight, by fishery in Area 2A. The bycatch mortality estimate for legal-sized halibut for 2005 is from this report. (Sums across fisheries may not equal the TOTAL due to rounding.)

Year	Foreign, JV & Catcher-Proc.	Groundfish Trawls	Shrimp Trawls	Hook & Line	TOTAL
1977	2	191	51	10	254
1978	1	191	51	10	253
1979	0.6	191	51	10	252
1980	0.6	191	51	10	252
1981	Trace	191	51	10	252
1982	Trace	191	51	10	252
1983	0.6	191	51	10	252
1984	Trace	191	51	10	252
1985	Trace	191	51	10	252
1986	0.6	191	51	10	252
1987	0.6	191	51	10	252
1988	0.6	191	51	10	252
1989	1	191	51	10	253
1990	1	191	51	10	253
1991	1	191	51	10	253
1992	0	239	27	10	275
1993	0	239	27	10	275
1994	0	239	27	10	275
1995	0	340	31	10	381
1996	0	340	31	10	381
1997	0	340	31	10	381
1998	0	692	16	---	---
1999	---	638	---	---	---
2000	---	523	---	---	---
2001	---	533	---	---	---
2002	---	286	---	---	---
2003	---	367	---	---	---
2004	---	172	---	---	---
2005	---	228	---	---	---
2006	---	252	---	---	---

Note: Bycatch mortality by groundfish trawls in 1998-2004 does not include fisheries off California. Bycatch mortality by shrimp trawls in 1998 does not include fisheries off California and Washington.

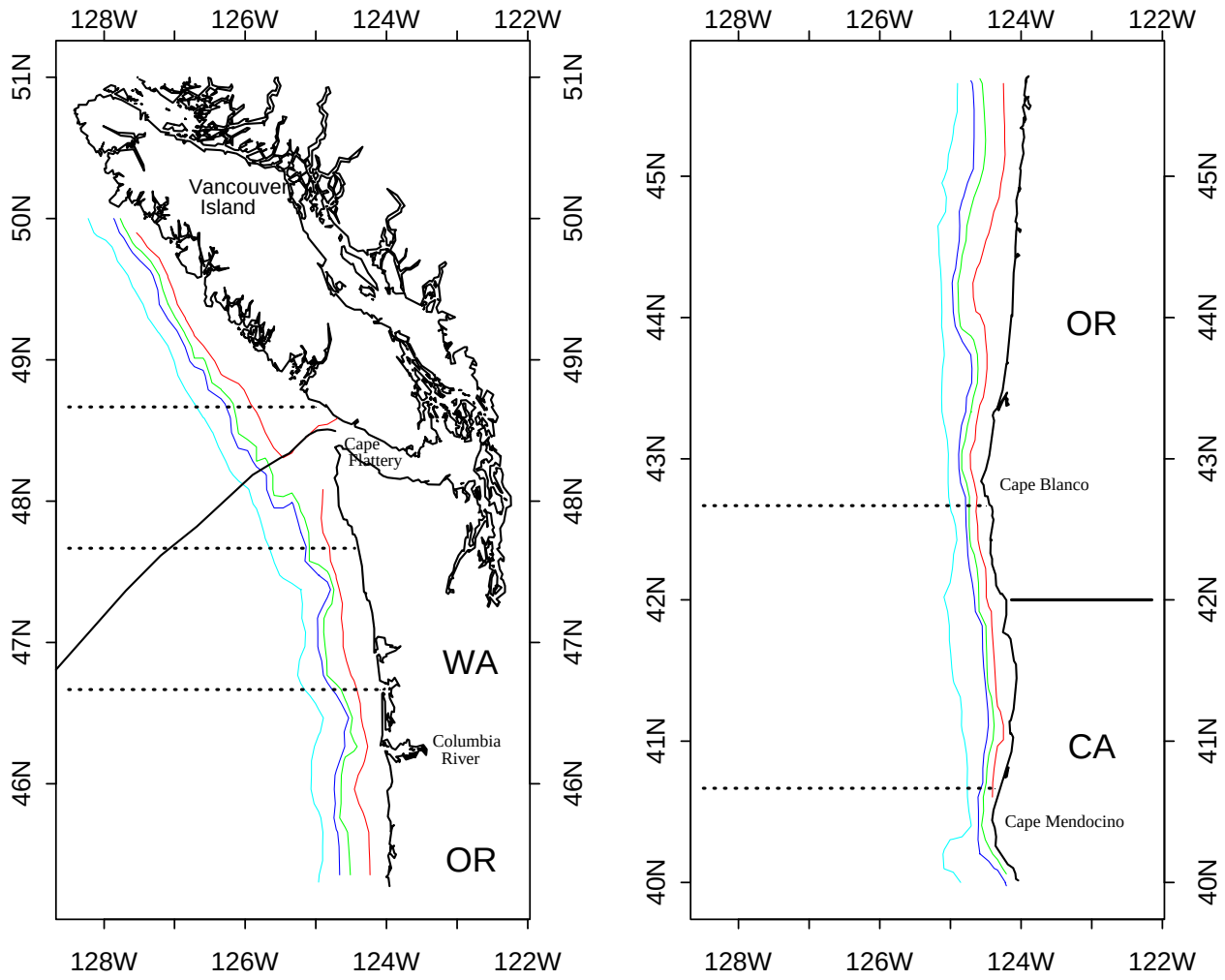

Figure 1. A map of IPHC area 2A with the latitudinal strata demarcated by dotted lines. In the most northerly strata only the area east of the EEZ line is covered by this report. Depth contours are plotted for 75, 150, 250, and 700 fathoms.

Pacific Halibut Bycatch in IPHC Area 2A in the 2006 Groundfish Trawl Fishery

John Wallace & Jim Hastie

NOAA Fisheries
Northwest Fisheries Science Center
Seattle, WA

September 2007

Three important changes in trawl management occurred in 2006

1. Less area was open to fishing prior to October, but considerably more area from October on.

2. Hence, the number of trawl hours shoreward of the RCA fell by ~1,200 from Jan. to Oct., but increased by ~1,600 from Sep. to Dec.

3. Trawling seaward of the RCA increased by ~2,800 hours, primarily due to the availability of petrale areas in Nov. and Dec.

Arrowtooth Catch (lb/h)	Latitude	Depth (fathoms)	Trawl effort (hours)		% change from 2005 to 2006
			2005	2006	
≤ 20	40.667 - 48.667	0 - 150	12,441	12,595	1%
		150 - 700	11,292	14,225	26%
		All depths	23,733	26,820	13%
> 20	40.667 - 48.667	0 - 150	6,986	7,236	4%
		150 - 700	8,659	8,547	-1%
		All depths	15,644	15,783	1%
Total	40.667 - 48.667	0 - 150	19,427	19,831	2%
		150 - 700	19,950	22,772	14%
		All depths	39,377	42,602	8%

Year	Trawl Effort (hours)	Total Halibut Mortality (lb, net)	Mortality (lb) per Trawl Hour	Legal-Sized Halibut Mortality (lb, net)	Legal-Sized / Total Halibut Mortality
2001	67,199	795,741	11.8	532,912	0.6697
2002	52,168	511,764	9.8	286,221	0.5593
2003	58,339	461,847	7.9	366,745	0.7941
2004	37,495	244,941	6.5	171,754	0.7012
2005	39,377	357,876	9.1	228,049	0.6372
2006	42,602	333,391 (134k-569k)	7.8	251,507 (99k-430k)	0.7544

Agenda Item H.2.c
Supplemental GAP Report
September 2007

GROUNDFISH ADVISORY SUBPANEL REPORT ON INTERNATIONAL PACIFIC HALIBUT COMMISSION (IPHC) ADOPTION

The Groundfish Advisory Subpanel (GAP) requests that the Council ask the IPHC to review their current assumption of trawl discard mortality, which is presumed to be at a rate of 50 percent. The West Coast Groundfish Observer Program records trawl caught halibut as in good or poor condition. Mortality of trawl caught halibut may be lower and a review of the data base may benefit all the user groups if this is the case.

PFMC
09/14/07

Agenda Item H.2.c
Supplemental SSC Report
September 2007

SCIENTIFIC AND STATISTICAL COMMITTEE REPORT ON PACIFIC HALIBUT BYCATCH ESTIMATE FOR INTERNATIONAL PACIFIC HALIBUT COMMISSION (IPHC)

The Scientific and Statistical Committee (SSC) reviewed a report by John Wallace and Jim Hastie on Pacific Halibut Bycatch in IPHC Area 2A in the 2006 groundfish trawl fishery (September 2007). The methodology employed to estimate Pacific halibut bycatch was unchanged from that used in the past two years. Halibut bycatch varies by season, depth, latitude, and the proportion of arrowtooth flounder in the catch. The SSC appreciates that confidence intervals (requested by the SSC last year) were included in this year's document.

The SSC notes that until estimation methods change from the current technique, which appears to have become routine, the SSC does not see the need for further review.

PFMC
09/12/07

PACIFIC HALIBUT STOCK ASSESSMENT

The International Pacific Halibut Commission (IPHC) introduced a modified approach to assessing the Pacific halibut stock at its 2007 Annual Meeting (Agenda Item H.3.a, Attachment 1). The closed-area assessments that have been standard for some years assume that the stock in each area is a closed population. There is now evidence of a continuing west-to-east migration of legal-sized fish that violates the assumption. While employing the same stock assessment model as had been used previously, the modified approach used the model to determine a single coastwide estimate of exploitable biomass, which does not require any assumptions about migration. This single coastwide estimate was then apportioned into IPHC regulatory area estimates using data from the fishery-independent IPHC setline stock assessment survey and estimates of bottom area from each regulatory area. The resultant allocation to Area 2A was a substantial reduction from recent years despite similar estimates of total abundance from the coastwide approach and from aggregating the closed-area assessments.

At the 2007 Annual Meeting, the IPHC Commissioners deferred adoption of the new approach until IPHC staff had conducted a workshop involving other stock assessment researchers and industry participants, to further explore the basis and implications of the new approach. The workshop was held June 27 and 28, 2007 in Seattle, and was well attended by staff from the various Area 2A agencies. At the workshop, presentations of the methodology used in the new coastwide assessment and abundance apportionment by catch area were made to a cross-section of attendees with science, policy, and industry backgrounds. Members of the Center for Independent Experts (CIE) were among the attendees, and they are reviewing the information presented, however their results are not yet available. The IPHC staff will also release a summary of the workshop, but not until after the September Council meeting.

The abundance index used to apportion the catch among areas was initially proposed to be average catch per unit of effort in the IPHC setline survey multiplied by bottom area less than 300 fathoms. Subsequent analysis indicated that adjustments may be appropriate for some areas due to survey depth distribution and hook competition factors in some areas, notably Area 2A (Agenda Items H.3.a, Attachments 2 and 3). The choice of an appropriate abundance index will likely have the greatest short term effect on Area 2A allocation if the coast-wide assessment methodology is adopted.

Council Action:

1. **Discuss scientific basis for coastwide stock assessment and area apportionment.**
2. **Develop recommendations for U.S. Commissioners on the IPHC for adoption of the proposed stock assessment and catch area apportionment methodology.**

Reference Materials:

1. Agenda Item H.3.a, Attachment 1; Summary of the 2006 stock assessment.
2. Agenda Item H.3.a, Attachment 2; Effect of station depth distribution on survey CPUE.
3. Agenda Item H.3.a, Attachment 3; Effect of hook competition on survey CPUE.

Agenda Order:

a. Agenda Item Overview — Chuck Tracy
b. Reports and Comments of Advisory Bodies
c. Public Comment
d. **Council Action**: Recommendations to IPHC

PFMC
08/22/07

Summary of the 2006 stock assessment

William G. Clark and Steven R. Hare

Abstract

Growing concerns about net migration from the western to the eastern Gulf of Alaska have led the staff to doubt the accuracy of the closed-area assessments that have been done for many years. A coastwide assessment with survey apportionment was therefore done in addition to the closed-area assessments this year, and was used to calculate the available yield in each area. The two kinds of assessments produced very similar estimates of total abundance (total exploitable biomass about 400 M lb, total available yield about 80 M lb) but the distribution among areas was quite different, with the coastwide assessment showing more biomass and available yield in Areas 3B and 4 than the closed-area assessments and less in Area 2. Area 3A is about the same in both assessments.

Introduction

Each year the International Pacific Halibut Commission (IPHC) staff assesses the abundance and potential yield of Pacific halibut using all available data from the commercial fishery and scientific surveys (Appendix A). A biological target level for total removals from each regulatory area is calculated by applying a fixed harvest rate to the estimate of exploitable biomass in that area. This target level is called the "constant exploitation yield" or CEY for that area in the coming year. The corresponding target level for catches in directed fisheries subject to allocation is called the fishery CEY. It comprises the commercial setline catch in all areas plus the sport catch in Areas 2A and 2B. It is calculated by subtracting from the total CEY an estimate of all unallocated removals—bycatch of legal-sized fish, wastage of legal-sized fish in the halibut fishery, fish taken for personal use, and sport catch except in Areas 2A and 2B. Staff recommendations for catch limits in each area are based on the estimates of fishery CEY but may be higher or lower depending on a number of statistical, biological, and policy considerations. Similarly, the Commission's final quota decisions are based on the staff's recommendations but may be higher or lower.

For many years the staff has assessed the stock in each regulatory area by fitting a model to the data from that area. This procedure relied on the assumption that the stock of fish of catchable size in each area was closed, meaning that net migration was negligible. A growing body of evidence from both the assessments (Clark and Hare 2007a) and the ongoing mark-recapture experiment (Webster and Clark 2007) shows that there is probably a continuing eastward net migration of catchable fish from the western Gulf of Alaska (Areas 3B and 4) to the eastern side (Area 2). The effect of this migration on the closed-area stock assessments is to produce underestimates of abundance in the western areas and overestimates in the eastern areas. To some extent this has almost certainly been the case for some time, meaning that exploitation rates have been well above the target level in Area 2 and a disproportionate share of the catches have been taken from there.

In order to obtain an unbiased estimate of the coastwide stock this year, the staff built a coastwide data set and fitted the model to it. The coastwide estimate of exploitable biomass (414 M lb) is close to the sum of the closed-area estimates. To estimate the exploitable biomass

in each regulatory area, the staff apportioned the coastwide total according to the setline survey index of exploitable biomass in each area (survey CPUE of legal-sized fish multiplied by bottom area). Comparison of this distribution to the closed-area assessments shows that the closed-area assessments were too high by 50-100% in Area 2, meaning that the actual harvest rates there have been 50-100% above the coastwide target.

The closed-area assessments overestimate present abundance in Area 2 because in effect they include fish that are migrating to Area 2 from areas to westward. It could be argued that these really are Area 2 fish, so some degree of disproportionate harvest is appropriate. And to some degree it appears to be feasible. According to the present estimates, it would mean taking 25% of the coastwide yield from Area 2, which contains 16% of the coastwide biomass. This would not be a conservation issue for the stock as a whole. The fishery has been prosecuted in that fashion for decades, and it is probably sustainable, although harvest rates in the western areas (the source of the migrating fish) have been higher since 1996 than in previous years.

On the other hand, the general practice and the stated policy of the Commission is to harvest in proportion to actual abundance in each area, which means reducing the exploitation rate in Area 2 to the target level, now 20% (Hare and Clark 2007).

In calculating the CEY (Constant Exploitation Yield) estimates for Area 2 in 2007, the staff has taken a middle course, applying a 25% harvest rate in Area 2 instead of the target. This approach moves the exploitation rate closer to the target but makes some allowance this year for the effect of eastward migration on the historical distribution of catches. In future years, reducing the harvest rate in Area 2 to the coastwide target can be expected to result in a rebuilding of biomass that will increase CEY at the lower harvest rate.

Development of a coastwide assessment

In 2006 growing concerns about evidence of migration of legal-sized fish from the western Gulf of Alaska (Areas 3B and 4) to the east (Area 2) led the staff to question the accuracy of the customary closed-area assessments, which assume that the stock in each area is a closed population (Clark and Hare 2007a). The effect of migration on the customary closed-area assessments is to produce underestimates of present abundance in the areas from which fish are emigrating (Areas 3B and 4) and overestimates in the areas into which they are immigrating (Area 2). This happens because emigration inflates the closed-area estimates of fishing mortality in the source areas and immigration shrinks them in the receiving area. Moreover, there is no assurance that the sum of the biased estimates from faulty closed-area assessments will be an accurate estimate of the total coastwide abundance, so the staff was concerned about our estimates of total abundance as well as our estimates of abundance in each regulatory area.

In order to obtain accurate estimates of abundance both coastwide and by area, the staff conducted a coastwide assessment (Clark and Hare 2007b) and then estimated the proportion in each regulatory area using the survey index of exploitable biomass in each area (survey CPUE of legal-sized fish multiplied by bottom area). The coastwide assessment is not affected by migration because fish on the move contribute to the single series of commercial and survey catch rates wherever they go. The estimate of total abundance can therefore expected to be accurate, and it is also more precise than the area-specific estimates because the coastwide data series are much less noisy than the data from individual areas.

Apportionment of the estimated coastwide biomass among regulatory areas is a difficult problem. Our best estimate of relative abundance in each area is certainly the survey index, but that relies on the assumption that survey catchability is the same in all areas, which is uncertain.

It seems likely that catchability is similar in Areas 2B and 2C, and in Areas 3A and 3B, but what about Areas 2A and 4B? Some checks for differences in survey catchability are reported below.

Data compilation

The first stage of work was to assemble coastwide series of commercial and survey data. Commercial catch-at-age and CPUE data series could be compiled straightforwardly because IPHC has collected specimen and logbook data from all areas for many years. Commercial CPUE data from Areas 2A and 4C were not included in the coastwide series because of unique features of the fisheries in those areas. Like the data series used for the closed-area assessments in Areas 3B and 4, the coastwide data series goes back only to 1996 because survey data are required to estimate the sex composition of commercial landings.

Survey data were more challenging because even in recent years there have been gaps in our survey coverage in Areas 2A, 4A, and 4D, and until 2006 no surveys at all on the eastern Bering Sea shelf, which comprises about half the continental shelf in the Commission area. The gaps in recent survey data in Areas 2A, 4A, and 4D were filled by interpolation in some cases and predictive relationships in others (Clark and Hare 2007a). A setline survey was done on the eastern Bering Sea shelf for the first time in 2006 (Dykstra et al. 2007). The 2006 survey CPUE (18 lb/skate) was used to scale an index of exploitable biomass calculated from the swept-area estimates of total abundance at length obtained from the annual NMFS trawl survey of the eastern Bering Sea shelf in 1982-2006.

Bycatch, sport catch, and personal use catches were similarly combined. In the end we had catch data sets including all removals, and properly weighted commercial and survey age composition and CPUE series representing the entire Commission area, including Area 4CDE. The coastwide data set is the same as any of the area-specific data sets; it just refers to the whole coast.

Model fits

The model fitted to the coastwide data is the same one used for the closed-area assessments. It can be fitted in various ways, the differences lying in how many parameters are estimated, what data types are fitted, and how the different data types are weighted. The standard coastwide fit has relatively few parameters and places a heavy weight on the total (not age-specific) commercial and survey CPUE series. This simple, rigid structure is needed for the closed-area assessments because some of the closed-area datasets are noisy. The coastwide dataset is much quieter so alternative fits could be considered. The staff did investigate a number of fits and chose a reference fit (Fig. 1) mainly on the basis of statistical goodness of fit. All of the alternatives gave exploitable biomass estimates in the vicinity of 400 M lb (Clark and Hare 2007b).

The reference fit estimates coastwide exploitable biomass at the start of 2007 to be 414 M lb. The sum of the closed-area assessments is 416 M lb, so at least in respect of total abundance the two kinds of assessment give the same result.

Area apportionment

To estimate the proportion of coastwide biomass in each regulatory area, we used a survey index of biomass calculated as the average of the last three years' survey CPUE of legal-sized fish multiplied by the bottom area lying between zero and 300 fathoms in each regulatory area.

The proportions and biomass estimates are shown in Table 1 in the section relating to the 2006 coastwide assessment.

Selectivity, target harvest rate, and CEY

In the coastwide assessment, exploitable biomass is calculated with the commercial length-specific selectivity schedule estimated in the assessment, and we have adopted that schedule as our standard commercial selectivity for use in the fishery simulations and calculations of spawning biomass per recruit that are done to choose a target harvest rate. The old standard was an average of Alaska commercial selectivities estimated in the closed-area assessments. The new coastwide schedule is a little higher, so a new harvest rate analysis produced a reduction in the target harvest rate, from 0.225 to 0.20 (Hare and Clark 2007).

The new coastwide target harvest rate of 0.20 was used to calculate total CEY in Areas 3A, 3B, and 4A. A lower rate was applied in Areas 4B and 4CDE for reasons given by Hare and Clark (2007). A higher rate—25%—was applied in Area 2. As explained below, this rate is at present midway between the coastwide target and the rate that would have to be applied to match the CEY that would be estimated by closed-area assessments in Area 2.

Comparison of the coastwide and closed-area assessments

The staff's biomass and CEY estimates are based mainly on the coastwide assessment with survey apportionment. We have also done the customary closed-area assessments for comparison (Fig. 2).

Standardization of commercial selectivities

In order to make the results of the coastwide and closed-area assessments comparable, we have calculated exploitable biomass in all areas with the new standard coastwide commercial selectivity, and we have generally used the new coastwide target harvest rate of 0.20 (0.15 in Areas 4B and 4CDE) to calculate CEY. For most areas this change has little effect, because for any given set of life history parameters, there is a tradeoff between the selectivity schedule used and the target harvest rate chosen, such that the target length-specific harvest rates come out about the same when a new selectivity and a new target harvest rate are adopted. The exception is Area 2B (and implicitly 2A), where exploitable biomass has been calculated in an irregular fashion for the last three years.

In 2003, when the present assessment model was adopted, the staff chose a standard commercial selectivity schedule that was near the middle of the schedules estimated in the closed-area assessments (Fig. 3). In fact it was very close to the average of all the locally estimated Alaska schedules, so it has been called the Alaska fixed schedule. This schedule was used in the harvest rate analysis that produced the old 0.225 target harvest rate, and it was used to calculate exploitable biomass in all areas except Area 2B (and implicitly 2A). It did not matter that it differed from the locally estimated schedules so long as the same schedule was used to do the harvest rate analysis and to calculate exploitable biomass. The locally estimated Area 2B schedule was substantially higher than the Alaska fixed schedule, and using the latter in Area 2B would have reduced the estimated exploitable biomass there by a third. The staff was unwilling to make such a drastic reduction on the strength of a new assessment and so used the locally estimated schedule for Area 2B. The same practice was followed in 2004 and 2005. This practice was irregular because we used the same target harvest rate in Area 2B as elsewhere, so in the case of Area 2B we were using one selectivity schedule for the harvest rate analysis and another

for the exploitable biomass calculation. In effect we were overstating the exploitable biomass in Area 2B (and 2A) by using a different yardstick there. Stated another way, we were fishing at a rate about 25% above the target rate appropriate to the higher selectivity.

In this year's closed-area assessments we have used the same commercial selectivity schedule—the coastwide standard—to calculate exploitable biomass in all areas including 2B (and 2A), and we have generally used the new coastwide target harvest rate (0.20). Except in Area 2B (and 2A), this just means applying a lower harvest rate to a higher exploitable biomass, because the coastwide schedule is higher than the old Alaska fixed schedule. But in Area 2B (and 2A) it means applying a lower harvest rate to a substantially lower biomass, because the coastwide schedule is lower than the locally estimated one. It is not as much lower as the old Alaska fixed schedule, but it lowers the calculated biomass by about a fifth (rather than a third).

Area-specific results

Along with the coastwide assessment results apportioned to areas according to the survey biomass index, Table 1 shows the evolution of closed-area results from last year's numbers to this year's. Last year's assessment estimated abundance at the beginning of 2006. This year's assessment re-estimates abundance at the beginning of 2006 in light of the 2006 data and also estimates abundance at the beginning of 2007. The 2007 exploitable biomass estimates are shown as they would have been calculated with the old standard commercial selectivities (local in Area 2B/2A, Alaska fixed elsewhere) and with the new coastwide standard.

In Area 2B, last year's closed-area estimate of biomass at the beginning of 2006 was 61 M lb, but that is revised downward sharply to 48 M lb in this year's closed-area assessment. This year's closed-area assessment estimates biomass at the beginning of 2007 to be 50 M lb as calculated with the old (local) selectivity, but only 39 M lb when calculated with the coastwide selectivity. Applying the coastwide target harvest rate of 20% to that gives a total CEY of 7.8 M lb, less than 60% of last year's 13.73 M lb. The main reasons for the decrease are the downward revision of estimated abundance at the start of 2006 (which also occurs in the 2C and 3B assessments) and the switch from local to coastwide selectivities. The lower harvest rate plays a small part. This year's estimate of exploitable biomass in Area 2B is 9.4% of the sum of closed-area estimates of exploitable biomass in 2007 (416 M lb). In contrast, last year's estimate of 61 M lb was 16% of the total. Even if we continued with the closed-area assessments, therefore, the estimated 2007 biomass in Area 2B would be much lower than last year, in both absolute and relative terms.

The survey estimate of the proportion of coastwide biomass in Area 2B is 6.5%, which applied to the coastwide estimate of 414 M lb gives 27 M lb in Area 2B. Given this biomass estimate, we would have to fish at 50% above the target rate to obtain the same CEY that would have been estimated for Area 2B if we had continued the closed-area assessments. The same is true in Areas 2A and 2C. It now appears that we have been fishing well above target in Area 2 for decades, and the fishery is probably sustainable so long as total removals from the entire stock are on target. Rather than ignore this longstanding pattern of exploitation, the staff has calculated CEY in Area 2 for 2007 using a harvest rate of 25% that is intermediate between the coastwide target (20%) and the historical practice (50% above 20% = 30% using this year's numbers). The estimated CEY of 6.75 M lb in Area 2B is therefore 25% of the biomass estimate of 27 M lb from the coastwide assessment.

Area 2A follows much the same course as Area 2B. The closed-area estimate of biomass in Area 2A is 12.5% of Area 2B biomass based on the survey index, and this relative value is

naturally the same when abundance in both areas is estimated by distributing the coastwide total according to the survey index.

The closed-area assessment in Area 2C follows a different course. There last year's closed-area estimate of biomass at the beginning of 2006 was 61 M lb, just as in Area 2B, and this estimate was also revised down sharply (to 47 M lb) in this year's closed-area assessment. But the change to coastwide selectivity then raises the Area 2C estimate to 57 M lb, close to last year's, with a CEY of 11.4 M lb. The 57 M lb estimated in Area 2C is 13.7% of the coastwide total, but the survey sees only 8.0% of the total in Area 2C, or 33 M lb, not much more than in Area 2B. At a harvest rate of 25%, this gives a total CEY of 8.25 M lb. Unlike Area 2B, therefore, Area 2C would not be greatly affected by changes in this year's closed-area assessment with coastwide selectivity, but it is greatly affected by the change to a coastwide assessment with survey apportionment.

In Area 3A, despite some ups and downs in the closed-area estimates, the total CEY is about the same in both kinds of assessment. Area 3A is the man in the middle, where exploitation rates have probably been close to the target in recent years.

As would be expected, Area 3B gains substantially from the coastwide assessment. This year's closed area estimate of CEY (10.4 M lb) is not much different from last year's (9.0 M lb), but the survey sees 20.8% of the coastwide biomass in Area 3B, giving a total CEY (at a 20% harvest rate) of 17.2 M lb. The relative increases are similar in Areas 4A and 4B although the absolute amounts are smaller.

Area 4CDE is unlike the other areas in that exploitable biomass there was calculated last year from the NMFS trawl survey estimate of total abundance. Last year's estimate was 36 M lb, which was calculated using a trawl survey catchability of 1.3 (rather than 1.0) to allow for herding. We have since been advised that halibut are probably not herded by the trawl bridles, so when we update that estimate this year we get 50 M lb. The setline survey of the eastern Bering Sea shelf in 2006 had a CPUE of 18 lb/skate, which when included in the survey index implies 10.1% share of coastwide biomass, or 41 M lb. Both of these estimates are valid, and either could be used this year. The trawl survey estimate is less variable than this year's setline survey CPUE (which a coefficient of variation of 20% vs 10% for the trawl survey), and there is no assurance that the setline survey will be repeated. In future years, therefore, it is likely that we will revert to using the trawl survey.

Checks for differences among areas in survey catchability

The area apportionments of exploitable biomass in this year's coastwide assessment rely on the survey index of abundance (survey CPUE multiplied by bottom area). Specifically, they assume that survey catchability is the same in all areas, meaning that a skate of survey gear fishing on the same density of fish on the bottom will have the same CPUE in all areas. This is not certain. It was long thought, for example, that survey catchability was lower in Area 2B because of competition with dogfish for the bait. Similarly, strong tides in some areas might be thought to reduce catchability.

In trawlable areas it is possible to check for differences in setline catchability among areas by comparing trawl and setline catch rates of fish of the same size. Figure 4 (reproduced from Clark and Hare 2007a) shows the ratio of IPHC setline to NMFS trawl survey catch rates at length in Areas 3A, 3B, and 4A, where the trawl survey can be expected to provide a reliable index of abundance. Unfortunately, this is not the case in other parts of the Gulf of Alaska. At

least in Areas 3A, 3B, and 4A, however, there is no indication of any large differences. The data are too noisy to rule out small or even moderate differences.

Another indication of differences among areas in survey catchability would be differences in the relative frequency of PIT tags in catches. The PIT tag release was done by tagging all fish caught on three skates of gear at every survey station in order to mark in proportion to abundance in all areas, so if survey catchability really is the same in all areas PIT tags should be recovered at the same rate (tags recovered per 10,000 fish scanned) in all areas. On the other hand, if survey catchability is low in some area, there should be fewer recoveries per 10,000 fish scanned from that area because a smaller proportion of the stock would have been marked on the survey. Table 2 shows the recovery rates of fish released coastwide in 2003 by year and area (Forsberg 2007 and references therein). In commercial catches there is no difference among Areas 2B, 3A, and 3B, but recovery rates were consistently and significantly higher in Area 2C, and there were some significant differences among ports in Area 3A. The recovery rate in Homer was consistently about half that in Kodiak and Seward.

In 2006 all fish caught on the IPHC setline survey were scanned as well, and there recovery rates were much higher than in commercial landings and consisted overwhelmingly of fish released at the station where they were caught. We thought we had achieved a very even distribution of marked fish by releasing them in proportion to abundance on the 10 nautical mile survey grid, but evidently the probability of catching a tagged fish depends on precisely where a boat fishes. There is probably some difference in the distribution of commercial fishing relative to the location of survey stations that accounts for the higher recovery rates in Area 2C and the lower rates in Homer. Whatever the reason, it reduces confidence in the finding that there is no difference in recovery rates among Areas 2B, 3A, and 3B.

The one clean comparison among areas is the recovery rates observed in the survey (last section of Table 2), which unfortunately were very few in Area 2. For what they are worth, however, they show no significant differences among areas with the exception of a marginally significant lower rate in Area 3B. In particular, like the commercial data they show no evidence of a lower recovery rate, and therefore a lower survey catchability, in Area 2.

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Table 1. Estimates of exploitable biomass and CEY from the 2006 assessment.

	Area 2A	Area 2B	Area 2C	Area 3A	Area 3B	Area 4A	Area 4B	Area 4CDE	Total
2006 total CEY	1.71	13.73	13.73	32.18	9.00	3.80	1.35	5.40	80.90
2006 catch limit [1]	1.38	13.22	10.63	25.20	10.86	3.35	1.67	3.55	69.86
2006 exploitable biomass									
2005 area assessments	7.6 [2]	61	61	143	45	19	9	36	382
2006 area assessments	6.0	48	47	163	35	16	11	50	376
2007 exploitable biomass									
2006 area assessments									
—Using old selectivities	6.3	50	48	159	40	15	10	50 [3]	378
—Using new selectivities	4.9	39	57	186	52	17	10	50	416
—Proportion of total	0.012	0.094	0.137	0.447	0.125	0.041	0.024	0.120	1.000
—Total CEY [4]	1.00	7.8	11.4	37.2	10.4	3.4	1.50	7.5	80.2
—Fishery CEY [5]	0.73	7.27	7.61	29.31	9.97	2.83	1.21	5.20	64.13
2006 coastwide assessment with survey apportionment									
—Survey proportion	0.009	0.065	0.080	0.423	0.208	0.069	0.045	0.101	1.000
—Exploitable biomass	3.7	27	33	176	86	29	19	41	414
—Total CEY [4]	0.93	6.75	8.25	35.2	17.2	5.8	2.85	6.15	83.13
—Fishery CEY [5]	0.66	6.22	4.46	27.31	16.77	5.23	2.56	3.85	67.06
Other removals									
Sport catch	0.52	2.26	3.03	6.09	0.01	0.06	---	---	11.97
Legal-sized bycatch	.23	.19	.14	1.32	0.36	0.46	0.28	2.21	5.19
Personal use	0.04	0.30	0.60	0.43	0.05	0.04	0.00	0.09	1.55
Legal-sized wastage	0.00	0.04	0.02	0.05	0.01	0.01	0.01	0.00	0.14
Total	0.79	2.79	3.79	7.89	0.43	0.57	0.29	2.30	18.85
…excluding sport catch	0.27	0.53	---	---	---	---	---	---	---

Notes on Table 1:
1. 2006 catch limit and 2007 fishery CEY include sport catch in Areas 2A and 2B.
2. Area 2A exploitable biomass estimated as 12.5% of Area 2B.
3. Increase in 4CDE results from a reduction of the working value of trawl survey catchability from 1.3 to 1.0.
4. In the area-specific assessments, total CEY is calculated as 20% of exploitable biomass in Areas 2A through 4A, and 15% in Areas 4B and 4CDE. In the coastwide assessment with survey apportionment, total CEY is calculated as 25% of exploitable biomass in Area 2, 20% in Areas 3 and 4A, and 15% in Areas 4B and 4CDE.
5. Fishery CEY is calculated as Total CEY less the other removals detailed below.

Table 2. Relative frequency of PIT tags released in 2003 in subsequent catches.

Type and year	Area of catch	Fish scanned (thousands)	Number of recoveries	Recoveries per 10,000 scanned ± std. dev.
2004 commercial	2B	209	72	3.4±0.4
	2C	125	92	7.4±0.8
	3A	448	128	2.9±0.3
	3B	320	80	2.5±0.3
2005 commercial	2B	196	57	2.9±0.4
	2C	147	86	5.9±0.6
	3A	511	194	3.8±0.3
	3B	276	117	4.2±0.4
2006 commercial	2B	219	73	3.3±0.4
	2C	138	69	5.0±0.6
	3A	511	183	3.6±0.3
	3B	203	67	3.3±0.4
Total commercial	2B	624	202	3.2±0.3
	2C	410	247	6.0±0.4
	3A	1469	505	3.4±0.2
	3B	799	264	3.3±0.2
2006 survey	2B	2.5	10	39±12
	2C	4.0	5	12±5
	3A	23.7	45	19±3
	3B	13.1	13	10±3
	Total	30.2	60	20±3

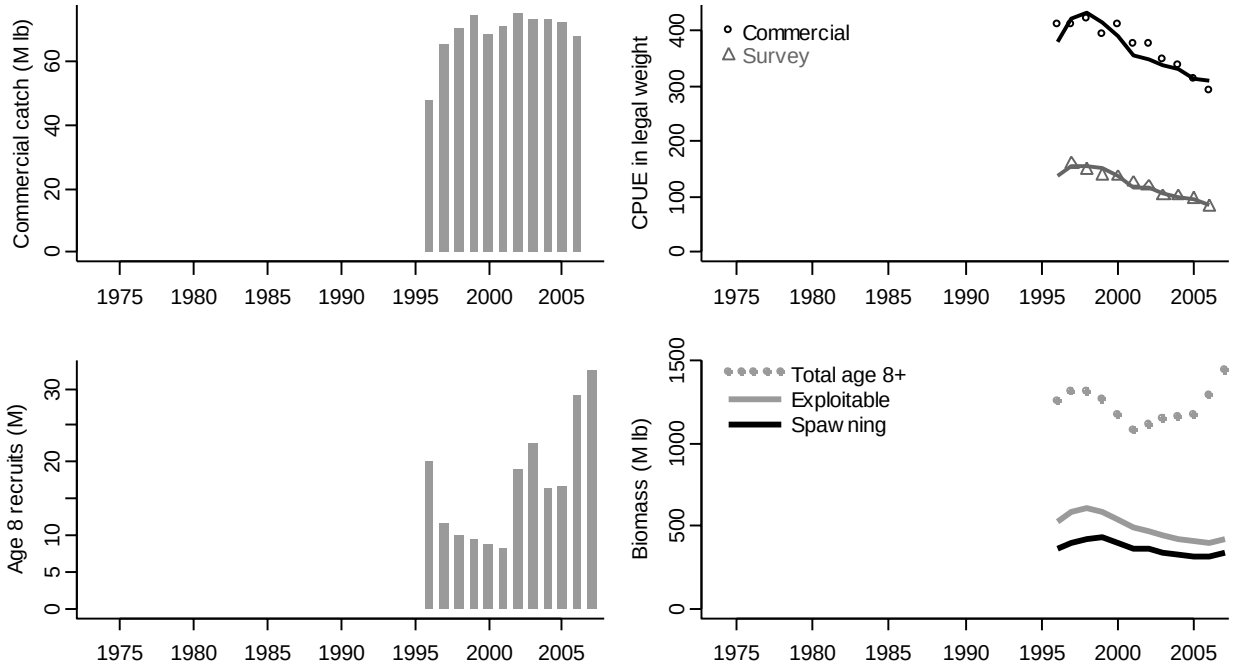

Figure 1. Features of the 2006 coastwide assessment. In the upper right panel, the points are observed CPUE (lb/skate) and the lines are model predictions.

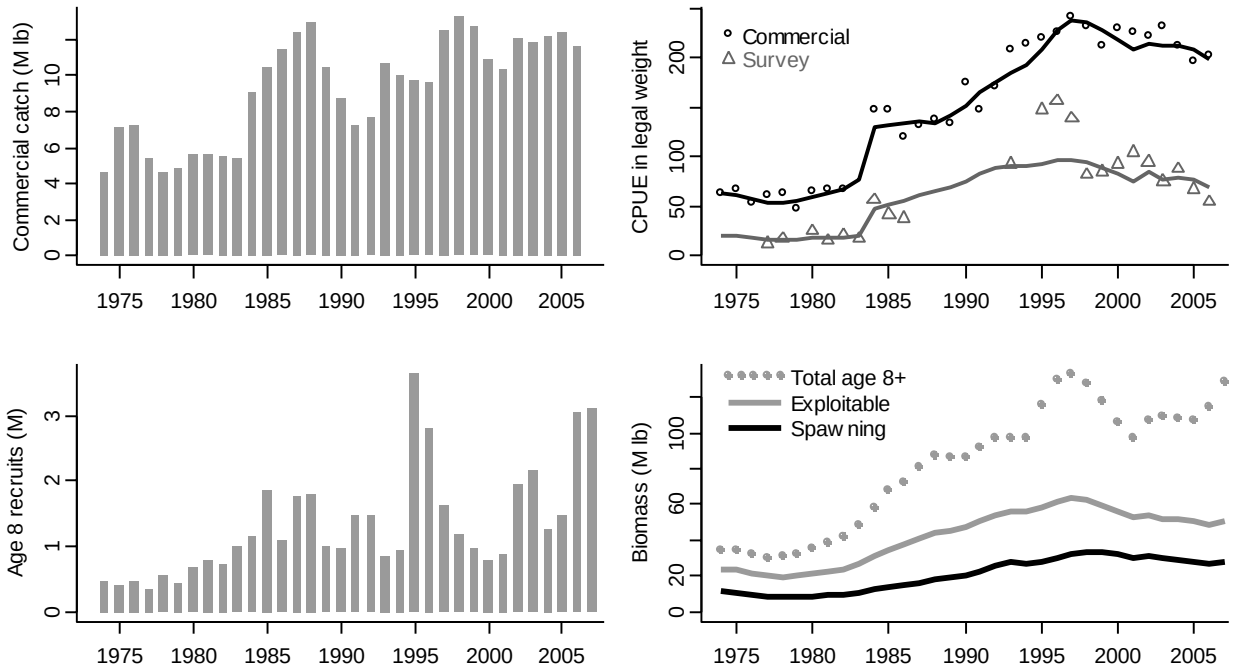

Fig. 2a. Features of the 2006 closed-area assessment in Area 2B.

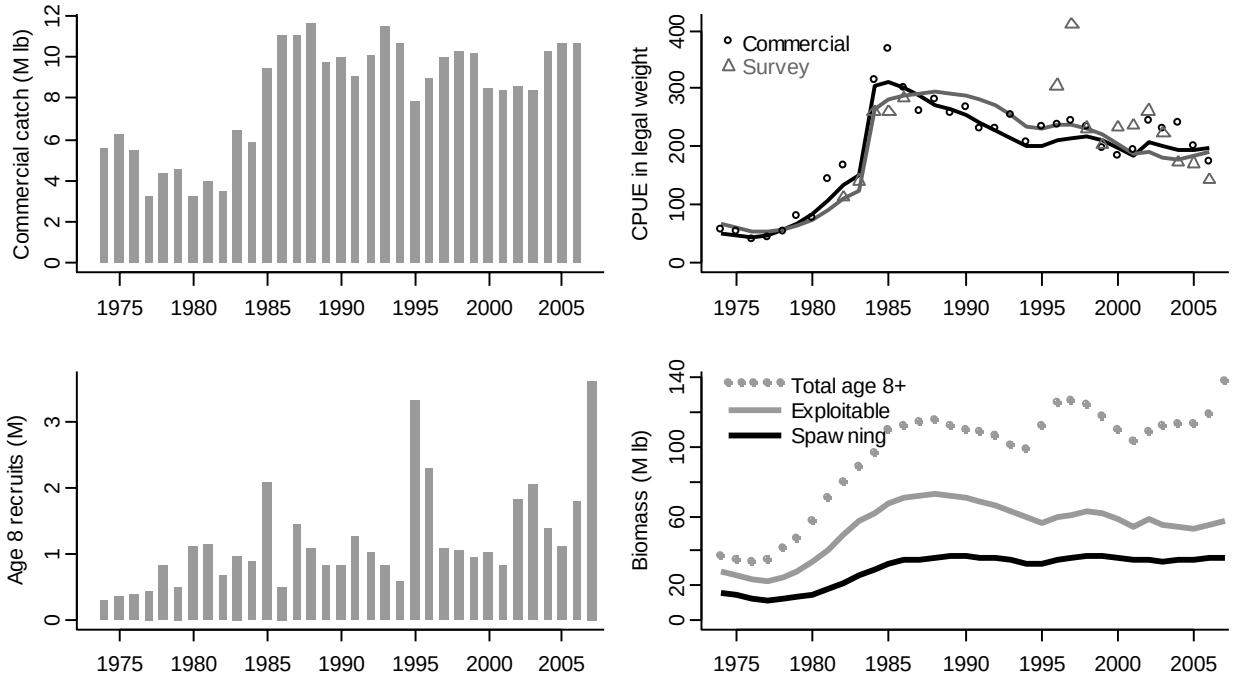

Fig. 2b. Features of the 2006 closed-area assessment in Area 2C.

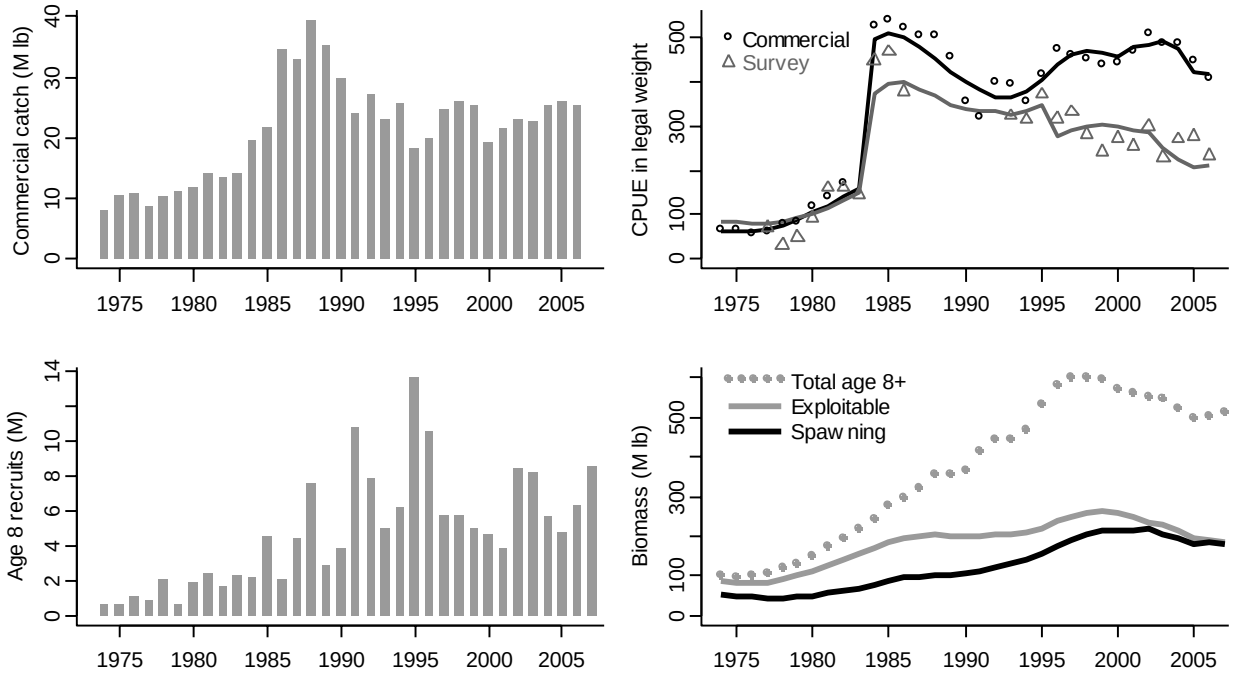

Figure 2c. Features of the 2006 closed-area assessment in Area 3A.

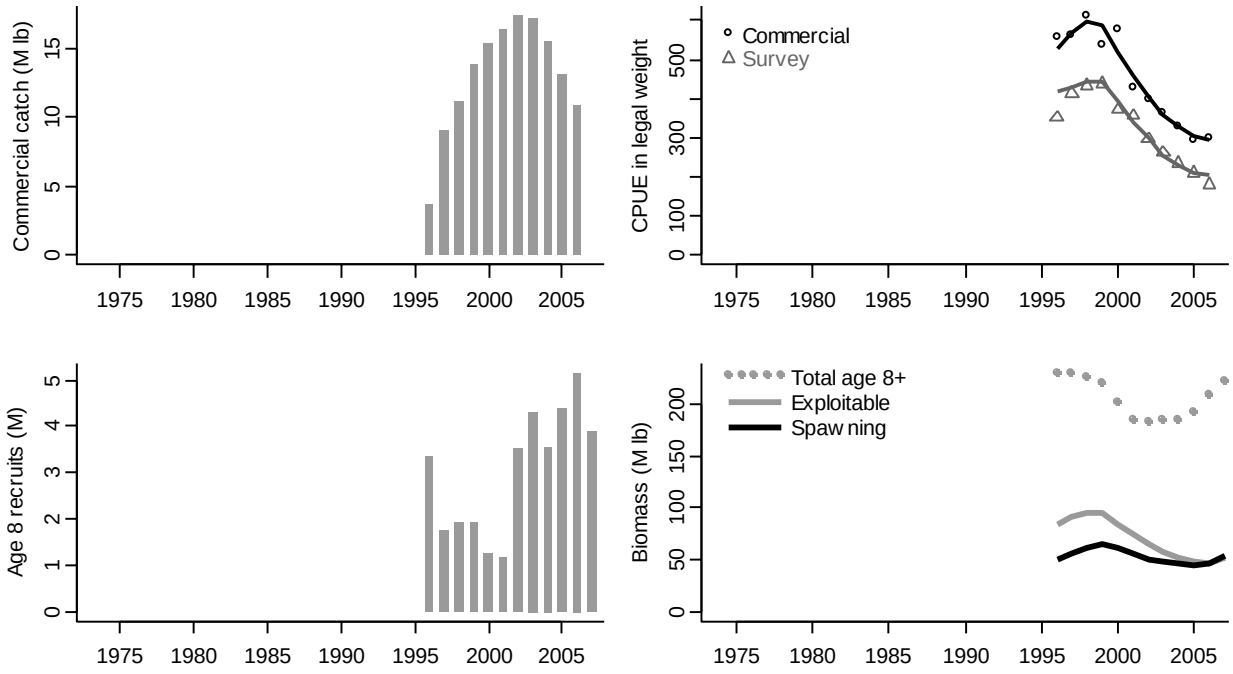

Figure 2d. Features of the 2006 closed-area assessment in Area 3B.

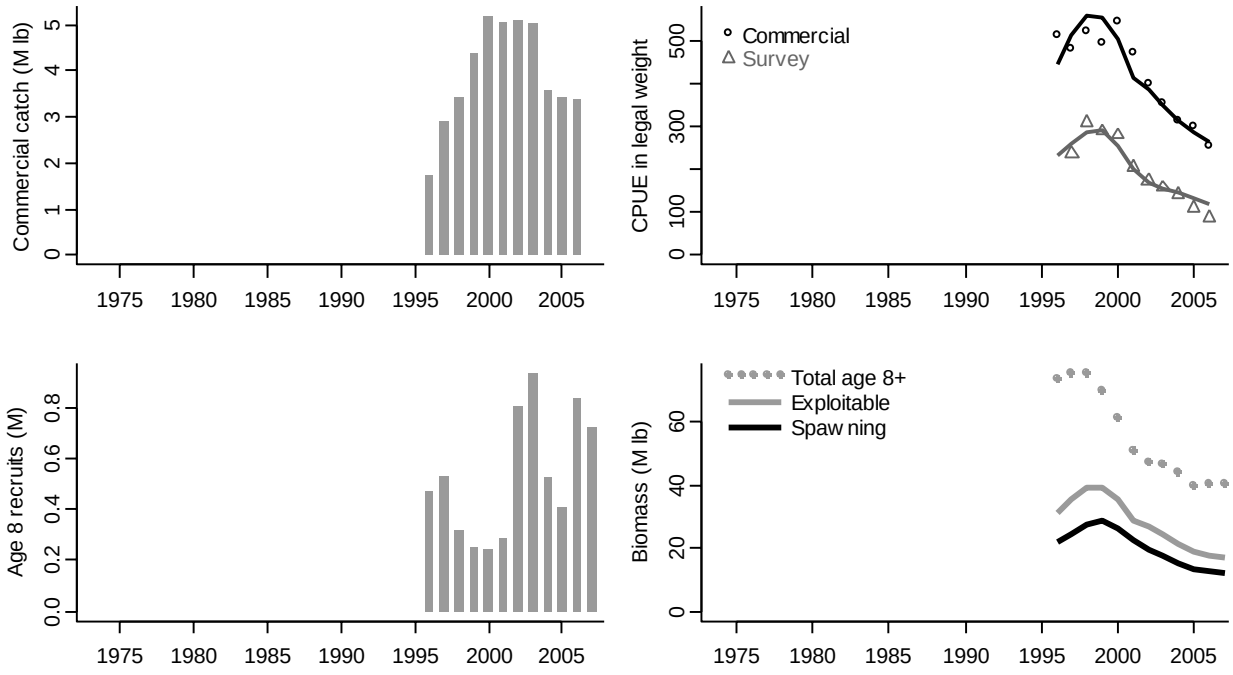

Figure 2e. Features of the 2006 closed-area assessment in Area 4A.

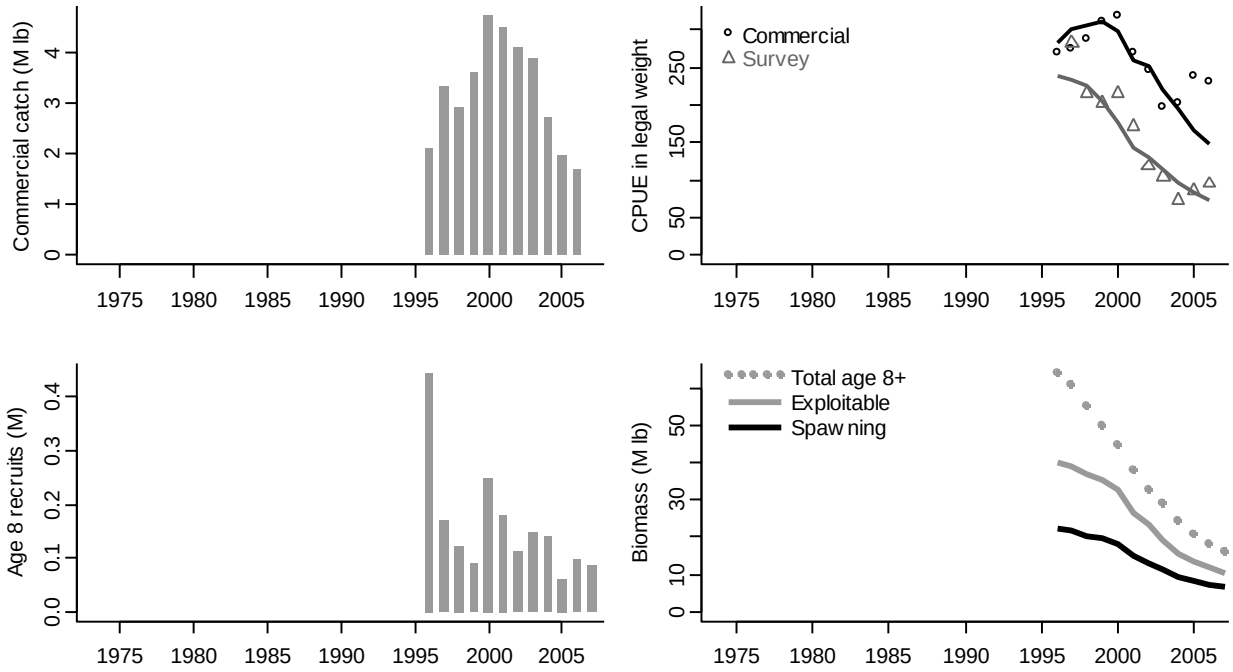

Figure 2f. Features of the 2006 closed-area assessment in Area 4B.

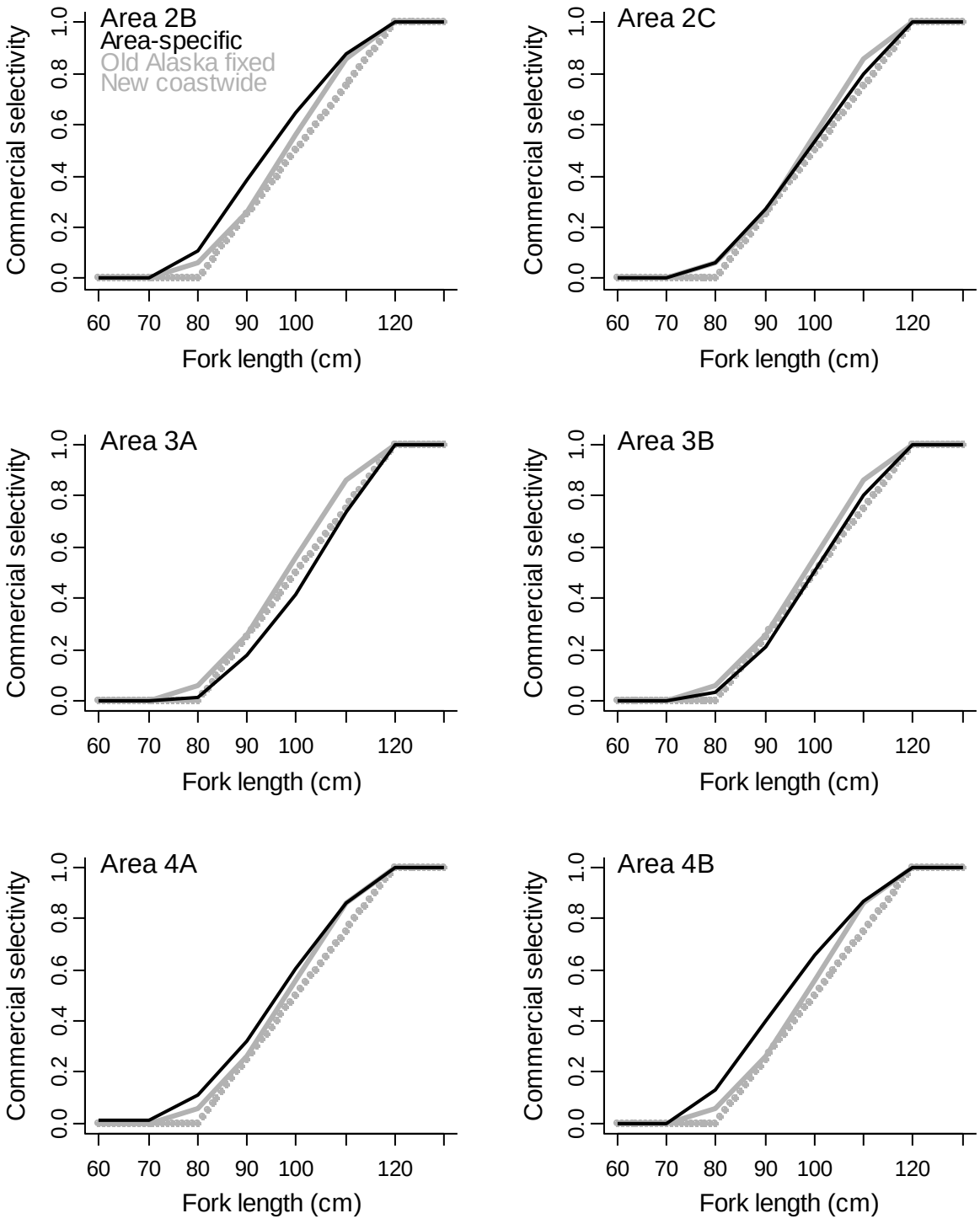

Figure 3. Commercial selectivity schedules. In each graph the broken gray line is the old standard (Alaska fixed) schedule, the solid gray line is the new coastwide standard schedule, and the black line is area-specific schedule estimated in the closed-area assessment for that area.

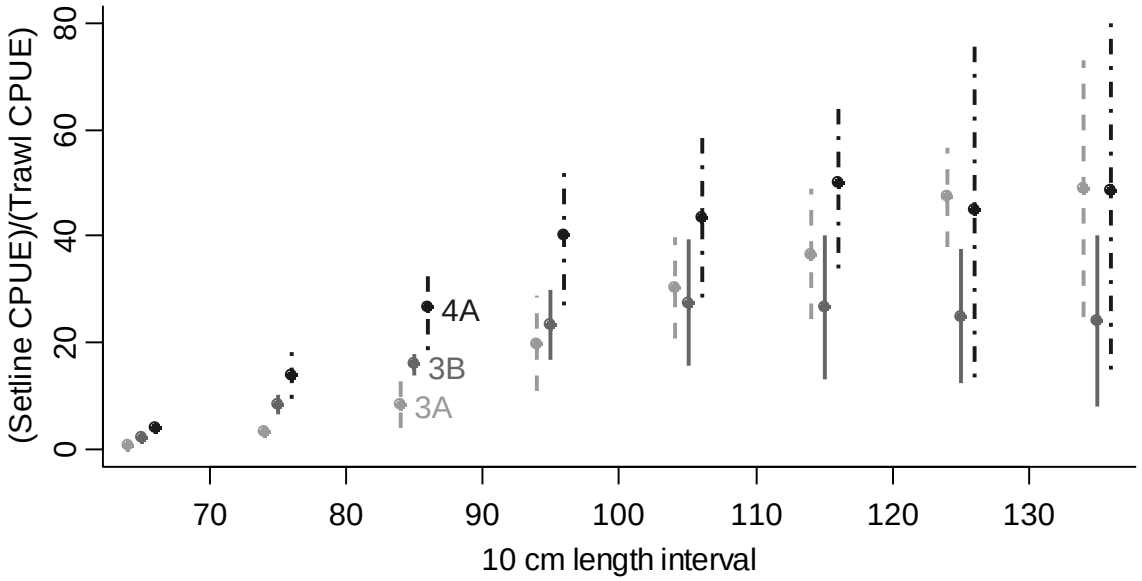

Figure 4. Ratio of setline survey catch rates at length (fish/skate) to trawl survey catch rates at length (fish/ha swept). The error bars are 95% confidence intervals.

Appendix A. Selected fishery and survey data summaries.

Table A1. Commercial catch (million pounds, net weight). Figures include IPHC research catches. Sport catch in Areas 2A and 2B is *not* included in this table.

	2A	2B	2C	3A	3B	4	4A	4B	4C	4D	4E	Total
1974	0.52	4.62	5.60	8.19	1.67	0.71	---	---	---	---	---	21.31
1975	0.46	7.13	6.24	10.60	2.56	0.63	---	---	---	---	---	27.62
1976	0.24	7.28	5.53	11.04	2.73	0.72	---	---	---	---	---	27.54
1977	0.21	5.43	3.19	8.64	3.19	1.22	---	---	---	---	---	21.88
1978	0.10	4.61	4.32	10.30	1.32	1.35	---	---	---	---	---	22.00
1979	0.05	4.86	4.53	11.34	0.39	1.37	---	---	---	---	---	22.54
1980	0.02	5.65	3.24	11.97	0.28	0.71	---	---	---	---	---	21.87
1981	0.20	5.66	4.01	14.23	0.45	---	0.49	0.39	0.30	0.01	0.00	25.74
1982	0.21	5.54	3.50	13.52	4.80	---	1.17	0.01	0.24	0.00	0.01	29.01
1983	0.26	5.44	6.38	14.14	7.75	---	2.50	1.34	0.42	0.15	0.01	38.39
1984	0.43	9.05	5.87	19.77	6.69	---	1.05	1.10	0.58	0.39	0.04	44.97
1985	0.49	10.39	9.21	20.84	10.89	---	1.72	1.24	0.62	0.67	0.04	56.10
1986	0.58	11.22	10.61	32.80	8.82	---	3.38	0.26	0.69	1.22	0.04	69.63
1987	0.59	12.25	10.68	31.31	7.76	---	3.69	1.50	0.88	0.70	0.11	69.47
1988	0.49	12.86	11.36	37.86	7.08	---	1.93	1.59	0.71	0.45	0.01	74.34
1989	0.47	10.43	9.53	33.74	7.84	---	1.02	2.65	0.57	0.67	0.01	66.95
1990	0.32	8.57	9.73	28.85	8.69	---	2.50	1.33	0.53	1.00	0.06	61.60
1991	0.36	7.19	8.69	22.93	11.93	---	2.26	1.51	0.68	1.44	0.10	57.08
1992	0.44	7.63	9.82	26.78	8.62	---	2.70	2.32	0.79	0.73	0.07	59.89
1993	0.50	10.63	11.29	22.74	7.86	---	2.56	1.96	0.83	0.84	0.06	59.27
1994	0.37	9.91	10.38	24.84	3.86	---	1.80	2.02	0.72	0.71	0.12	54.73
1995	0.30	9.62	7.77	18.34	3.12	---	1.62	1.68	0.67	0.64	0.13	43.88
1996	0.30	9.54	8.87	19.69	3.66	---	1.70	2.07	0.68	0.71	0.12	47.34
1997	0.41	12.42	9.92	24.63	9.07	---	2.91	3.32	1.12	1.15	0.25	65.20
1998	0.46	13.17	10.20	25.70	11.16	---	3.42	2.90	1.26	1.31	0.19	69.76
1999	0.45	12.70	10.14	25.32	13.84	---	4.37	3.57	1.76	1.89	0.26	74.31
2000	0.48	10.81	8.44	19.27	15.41	---	5.16	4.69	1.74	1.93	0.35	68.29
2001	0.68	10.29	8.40	21.54	16.34	---	5.01	4.47	1.65	1.84	0.48	70.70
2002	0.85	12.07	8.60	23.13	17.31	---	5.09	4.08	1.21	1.75	0.56	74.66
2003	0.82	11.79	8.41	22.75	17.23	---	5.02	3.86	0.89	1.96	0.42	73.19
2004	0.88	12.16	10.23	25.17	15.46	---	3.56	2.72	0.95	1.66	0.31	73.11
2005	0.80	12.33	10.63	26.03	13.17		3.40	1.98	0.53	2.58	0.37	71.82
2006	0.82	11.78	10.47	25.38	11.03		3.31	1.60	0.50	2.40	0.36	67.64

Table A2. Commercial CPUE (net pounds per skate).

Values before 1984 are raw J-hook catch rates, with no hook correction. 1983 is excluded because it consists of a mixture of J- and C-hook data. No value is shown for area/years after 1980 with fewer than 500 skates of reported catch/effort data.

	2A	2B	2C	3A	3B	4A	4B	4C	4D	4E	Total
J-hook CPUE:											
1974	59	64	57	65	57	---	---	---	---	---	---
1975	59	68	53	66	68	---	---	---	---	---	---
1976	33	53	42	60	65	---	---	---	---	---	---
1977	83	61	45	61	73	---	---	---	---	---	---
1978	39	63	56	78	53	---	---	---	---	---	---
1979	50	48	80	86	37	---	---	---	---	---	---
1980	37	65	79	118	113	---	---	---	---	---	---
1981	33	67	145	142	160	158	99	110	---	---	---
1982	22	68	167	170	217	103	---	91	---	---	---
1983	---	---	---	---	---	---	---	---	---	---	---
C-hook CPUE:											
1984	63	148	314	524	475	366	161	---	197	---	367
1985	62	147	370	537	602	333	234	---	330	---	407
1986	60	120	302	522	515	265	---	427	239	---	365
1987	57	131	260	504	476	341	220	384	---	---	357
1988	134	137	281	503	655	453	224	---	201	---	405
1989	124	134	258	455	590	409	268	331	384	---	381
1990	168	175	269	353	484	434	209	288	381	---	335
1991	158	148	233	319	466	471	329	223	398	---	330
1992	115	171	230	397	440	372	278	249	412	---	337
1993	147	208	256	393	514	463	218	257	851	---	376
1994	93	215	207	353	377	463	198	167	480	---	321
1995	116	219	234	416	476	349	189	---	475	---	348
1996	159	226	238	473	556	515	269	---	---	---	411
1997	226	241	246	458	562	483	275	335	671	---	412
1998	194	232	236	451	611	525	287	287	627	---	421
1999	---	213	199	437	538	500	310	270	535	---	393
2000	263	229	186	443	577	547	318	223	556	---	411
2001	169	226	196	469	431	474	270	203	511	---	377
2002	181	222	244	507	399	402	245	148	503	---	376
2003	184	231	233	487	364	355	196	105	389	---	350
2004	145	212	240	485	328	315	202	120	444	---	338
2005	155	197	203	446	293	301	238	91	379	---	313
2006	131	202	174	407	299	257	231	71	294	NA	292

Table A3. IPHC setline survey CPUE of legal sized fish in weight (net pounds per skate). Figures refer to all stations fished. For years when only the northern portion of Area 2B was fished, the CPUE is multiplied by 0.89 to reflect the relationship between overall CPUE and northern CPUE in years when the whole area was fished. The eastward expansion of the 3A survey in 1996 lowered average CPUE by around 25%; the raw values in the table should not be taken at face value. *No hook corrections* are applied; J-hook values are raw J-hook catch rates. Area 4EBS is the eastern Bering Sea shelf, first surveyed in 2006. The Total column is affected by a constructed series of eastern Bering Sea values (not shown).

	2A	2B	2C	3A	3B	4A	4B	4C	4D	4EBS	Total
J-hook surveys:											
1974	---	---	---	---	---	---	---	---	---	---	---
1975	---	---	---	---	---	---	---	---	---	---	---
1976	---	---	---	---	---	---	---	---	---	---	---
1977	---	13	---	73	---	---	---	---	---	---	---
1978	---	18	---	34	---	---	---	---	---	---	---
1979	---	NA	---	51	---	---	---	---	---	---	---
1980	---	25	---	95	---	---	---	---	---	---	---
1981	---	16	---	162	---	---	---	---	---	---	---
1982	---	21	145	180	---	---	---	---	---	---	---
1983	---	18	142	147	---	---	---	---	---	---	---
1984	---	25	---	217	---	---	---	---	---	---	---
C-hook surveys:											
1984	---	57	260	446	---	---	---	---	---	---	---
1985	---	42	260	466	---	---	---	---	---	---	---
1986	---	38	283	377	---	---	---	---	---	---	---
1987	---	NA	---	---	---	---	---	---	---	---	---
1988	---	NA	---	---	---	---	---	---	---	---	---
1989	---	NA	---	---	---	---	---	---	---	---	---
1990	---	NA	---	---	---	---	---	---	---	---	---
1991	---	NA	---	---	---	---	---	---	---	---	---
1992	---	NA	---	---	---	---	---	---	---	---	---
1993	---	93	---	323	---	---	---	---	---	---	---
1994	---	NA	---	313	---	---	---	---	---	---	---
1995	29	148	---	370	---	---	---	---	---	---	---
1996	---	156	306	317	352	---	---	---	---	---	---
1997	35	139	411	331	415	237	282	71	111	---	160
1998	---	82	232	281	435	310	216	---	---	---	149
1999	37	85	204	241	438	382	203	---	---	---	139
2000	---	93	233	272	373	286	216	---	213	---	136
2001	41	105	237	256	357	207	171	---	197	---	126
2002	33	95	261	299	297	174	119	---	257	---	120
2003	22	75	223	229	262	159	104	---	195	---	102
2004	27	88	173	270	236	142	73	---	132	---	102
2005	28	67	171	276	211	111	86	---	69	---	96
2006	16	55	144	232	181	88	95	---	63	18	83

Effect of station depth distribution on survey CPUE

William G. Clark

Abstract

IPHC setline surveys stations are set on a 10 nmi grid in depths from 20 to 275 fm, so the depth distribution of the survey stations should approximate the depth distribution of the bottom in each regulatory area, and the simple mean CPUE should be the same as the depth-stratified mean CPUE. This is true in all areas except Area 2A, where the depth-stratified mean is consistently higher than the simple mean, by an amount averaging 40%.

Background

In the 2006 assessment (Clark and Hare 2007) the staff estimated coastwide abundance by fitting the standard assessment model to a coastwide data set, and then estimated exploitable biomass in each regulatory area by apportioning the total in proportion to an estimate of stock distribution derived from the setline survey. Specifically, an index of abundance in each area was calculated by multiplying setline CPUE (running 3-year average) by total bottom area between 0 and 300 fm. The logic of this index is that survey CPUE can be regarded as an index of density, so multiplying it by bottom area gives a quantity proportional to total abundance. The estimated proportion in each area is then the index value for that area divided by the sum of the index values.

The survey CPUE value used for each area in each year is the simple mean of the CPUE values recorded at all stations fished in that area. The stations are set on a 10 nmi grid between 20 and 275 fm so they provide a uniform coverage of every area. As a result, the various conditions that could affect CPUE—such as depth, substrate type, temperature, dissolved oxygen—should be represented in the stations in approximately the same proportions as in the area as a whole. The simple mean of all the station values should therefore be close to the mean that would be obtained by stratifying the stations by e.g. depth, computing a mean CPUE for each depth stratum, and then computing an overall CPUE by weighting the stratum means by the actual proportion of bottom in each depth stratum.

At the 2007 annual meeting there was some concern expressed that the simple mean CPUE failed to account for the variation in CPUE with depth. This paper addresses that concern. The depth distribution of survey stations is compared with the depth distribution of the bottom in each area, and the depth-stratified mean CPUE is compared with the simple mean CPUE. They are the same in all areas except Area 2A, where the depth-stratified mean is 40% higher.

Depth distribution of survey stations, bottom, and commercial catch

Figure 1 shows the cumulative depth distribution of survey stations and bottom in each regulatory area. As expected they are quite similar but there are some differences. There is a small excess of shallow stations in Area 2A, a small excess of deep stations in Area 2C, and a substantial excess of shallow stations in Area 4B. The comparison is not shown for Area 4C because it is not surveyed, nor for Area 4D which is partially surveyed.

For information, Figure 2 shows the depth distribution of commercial catch in each area as a check on whether the maximum survey depth of 275 fm is deep enough. It is. More than 98% of the commercial catch is taken at depths less than 280 fm in all areas except Area 4A, where the proportion is 94%.

Variation of survey CPUE with depth

The effect of any mismatch between survey station depth distribution and bottom depth distribution in a given area will depend on how survey CPUE varies with depth in that area. The effect of depth was estimated by fitting a generalized additive model to survey CPUE from 2001-2006 in which year entered as factor to account for changes over time and depth entered as a smooth function. Set time and soak time were also included in initial fits but neither was significant so they were dropped. The smooth functions estimated for the depth effect are plotted in Figure 3.

In most areas the variation with depth while highly significant is not very large. The exceptions are Area 2A and to a lesser extent Area 2C. In Area 2A catch rates are low in shallow water, so the excess of shallow stations in Area 2A can be expected to have an important effect.

Unstratified and depth-stratified survey CPUE series

Figure 4 shows the bottom line: a comparison of simple mean CPUE series and depth-stratified CPUE series for each area. The two are very close in all areas except Area 2A, where the depth-stratified CPUE is consistently higher, by an amount averaging 40%.

Discussion

Except for Area 2A, the results presented here show that there is no need to calculate a depth-stratified survey CPUE. Because of the uniform station distribution, the simple mean CPUE accounts for the depth effect in all areas except Area 2A. This is a good outcome, because computing a depth-stratified estimate would complicate the assessment and possibly raise some statistical problems. In Area 2A some adjustment may be appropriate, but it is difficult to choose a number. The Area 2A survey CPUE has a high sampling variance either way it is computed. The depth-stratified CPUE exceeds the simple mean by an average of 40%, but that excess has a standard deviation of 10%, so an approximate 95% confidence interval for the adjustment is 20-60%.

References

Clark, W.G., and Hare, S.R. 2007. Assessment of the Pacific halibut stock at the end of 2006. Int. Pac. Halibut Comm. Report of Assessment and Research Activities 2006:97-128.

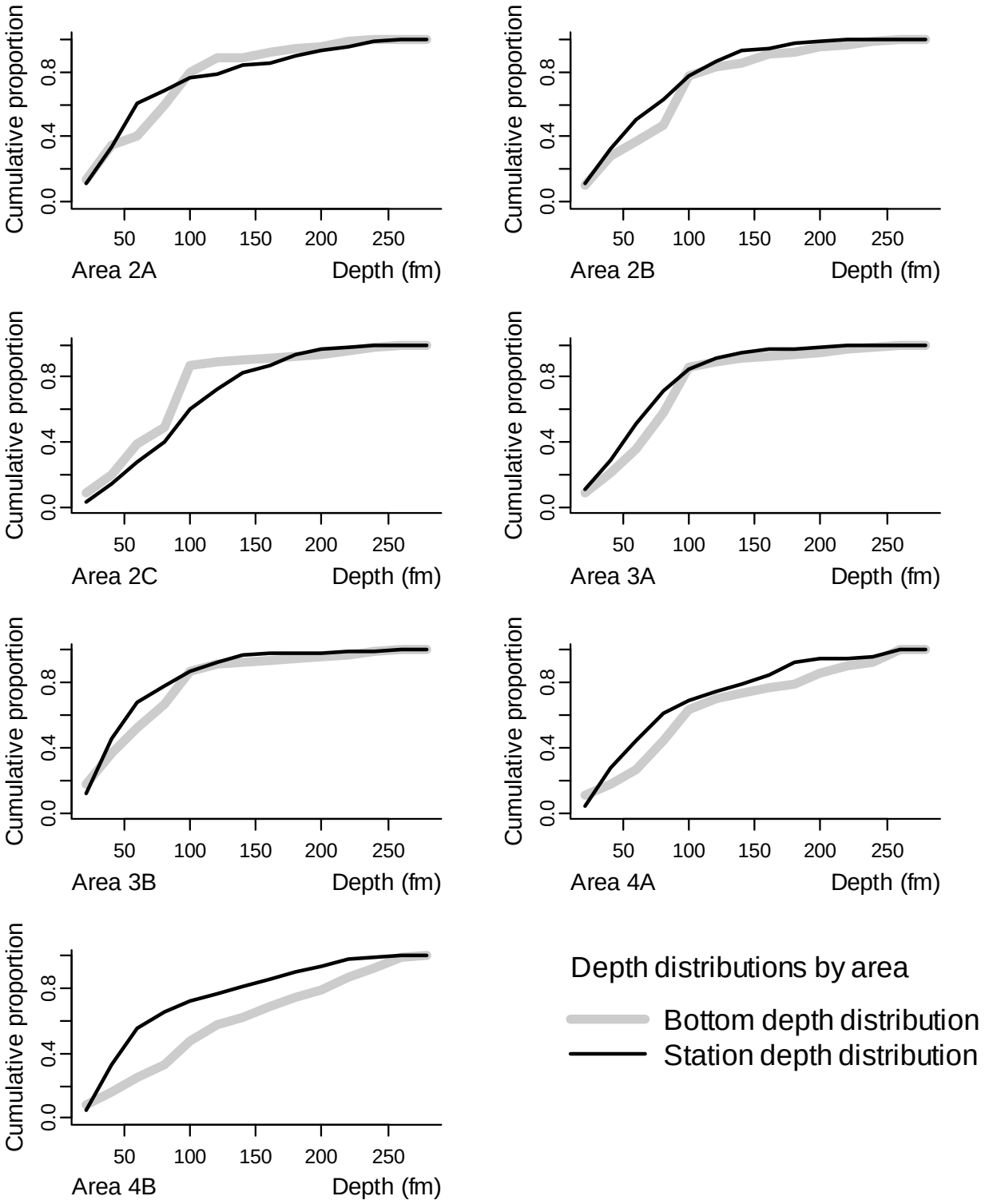

Figure 1. Cumulative distribution of bottom depth and survey station depth in each area.

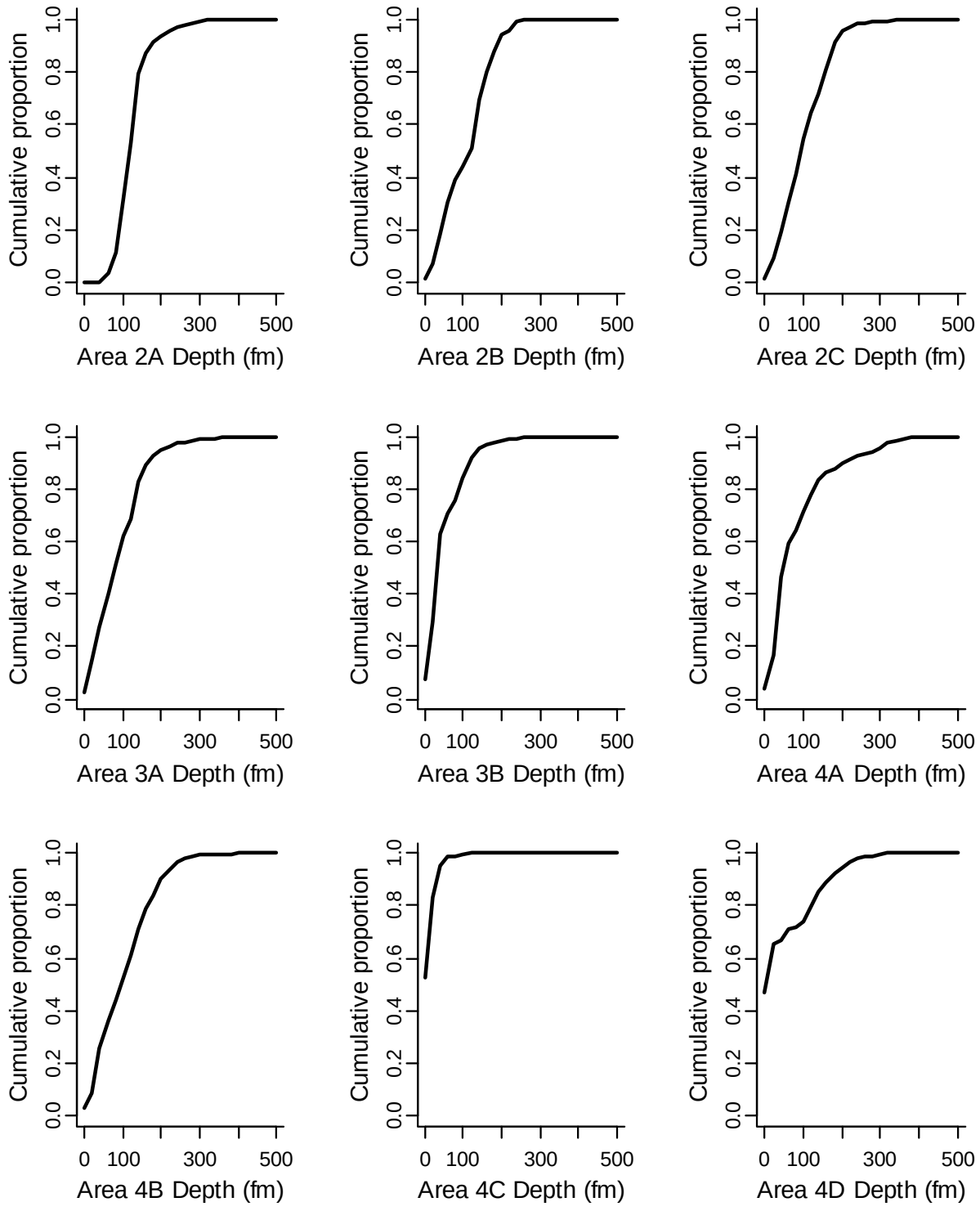

Figure 2. Cumulative depth distribution of commercial catch (2004-2006) in each area.

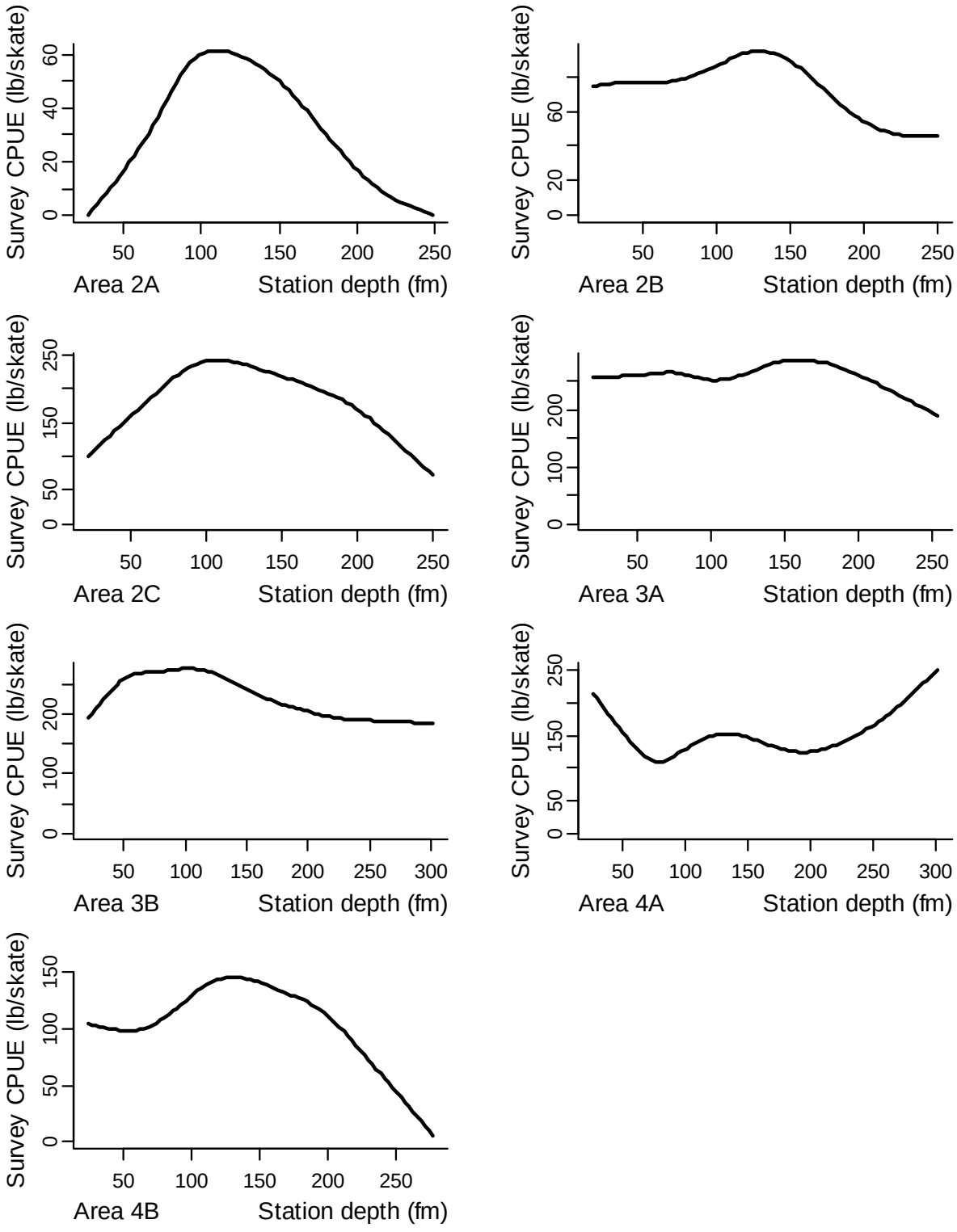

Figure 3. Variation of survey CPUE (2001-2006) with depth in each area. The plotted line is the depth term from a fitted generalized additive model with year as a factor and depth as a smooth function.

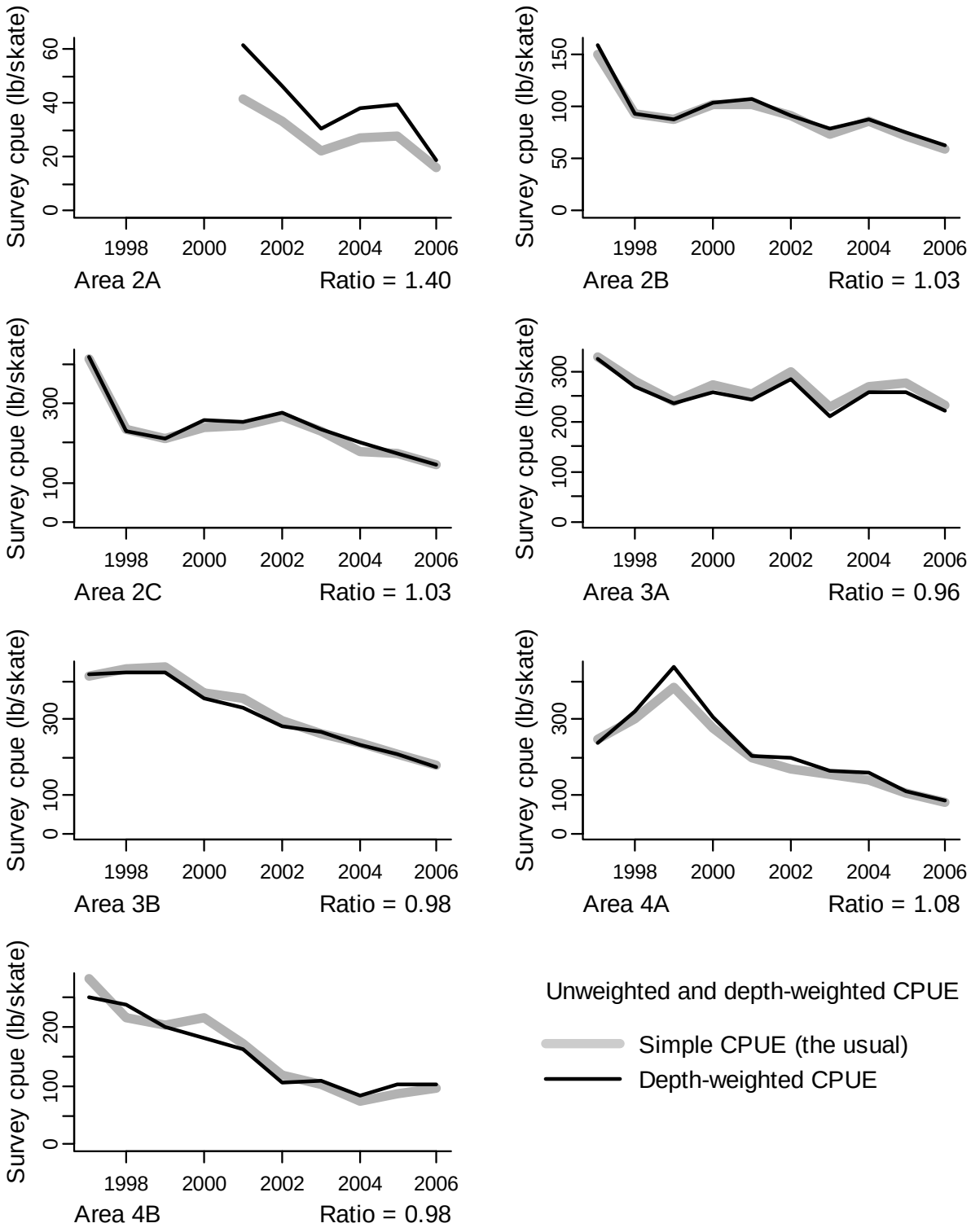

Figure 4. Comparison of simple and depth-stratified survey CPUE series in each area. The ratio shown at the lower right of each graph is the sum of the stratified estimates divide by the sum of the simple means.

Effect of hook competition on survey CPUE

William G. Clark

Abstract

The catch of halibut at setline survey stations is reduced by other species that take the bait. Hook competition is highest in Area 2A and lowest in Areas 4B and 4D. Despite some differences in catch composition, overall hook competition varies little among Areas 2B, 2C, 3A, 3B, and 4A.

Background

In the 2006 assessment (Clark and Hare 2007) the staff estimated coastwide abundance by fitting the standard assessment model to a coastwide data set, and then estimated exploitable biomass in each regulatory area by apportioning the total in proportion to an estimate of stock distribution derived from the setline survey. Specifically, an index of abundance in each area was calculated by multiplying setline CPUE (running 3-year average) by total bottom area between 0 and 300 fm. The logic of this index is that survey CPUE can be regarded as an index of density, so multiplying it by bottom area gives a quantity proportional to total abundance. The estimated proportion in each area is then the index value for that area divided by the sum of the index values.

This procedure assumes that survey catchability (the constant of proportionality between CPUE and the density of halibut on the bottom) is the same in all areas. But the CPUE of halibut is reduced by the number of baits taken by other species, and if the strength of this effect varies among areas the result would be differences in survey catchability among areas. In particular, it has long been suspected that the large number of dogfish caught in Area 2B depressed survey CPUE of halibut there, and almost certainly it does. Similarly, the large number of cod caught in Area 4 can be presumed to lower the CPUE of halibut there.

This paper reports estimates of the effect of hook competition on the survey CPUE of halibut in each regulatory area. It turns out that the effect is very similar in all regulatory areas except 2A and 4B, so the simple procedure used in the 2006 assessment was sound for the most part.

Mathematical treatment of hook competition

The sequence of events that occurs when a baited longline is set and various species go after the bait has been studied theoretically and experimentally for decades (Sigler 2000 and references therein). Mathematically the process of baits being removed from a longline by different species is the same as the process of fish being removed from a population by different fisheries and natural predators. We can represent each kind of bait taker as removing a certain proportion of the baits per unit time, so that the number of baits B_i taken by a given species *i* during a soak time *T* is given by the familiar catch equation:

$$B_i = F_i \cdot B_0 \cdot \left(1 - \exp\left(-Z \cdot T\right)\right) / Z$$

where F_i is the instantaneous rate of bait removal by species *i*, B_0 is the initial number of baited hooks, and $Z = \sum_j F_j$ is the sum of the instantaneous rates applied by all bait takers. This formulation has been found to describe quite well the actual sequence of catches during the first few hours of soaking in experiments where the time of each capture was recorded by a hook timer (Sigler 2000; Somerton and Kikkawa 1994). After the first few hours the rates of bait removal by all takers drops off, either because the remaining bait has lost its scent or because the bait takers in the vicinity of the gear have been depleted. This has also been observed for halibut in unpublished hook timer experiments conducted by IPHC (Steven Kaimmer, IPHC, pers. comm.). Beyond a certain point, therefore, soak time does not matter.

In the IPHC setline survey every string soaks for at least five hours, and there is no significant difference in CPUE between shorter and longer soaks in any area. (Set time is also insignificant.) Soak time can therefore be regarded as effectively the same for all survey sets, and the term *T* can be left out of the bait removal equation.

The instantaneous rate of bait removal by halibut can be taken to be proportional to the local density of halibut, and depending on size and gear selectivity some proportion of halibut that take a bait will also be hooked and caught, so the catch per skate of halibut C_h will be proportional to the density of halibut D_h multiplied by the last term in the bait removal equation:

$$C_h = k \cdot B_h = k \cdot F_h \cdot B_0 \cdot \left(1 - \exp\left(-Z\right)\right) \Big/ Z = k' \cdot D_h \cdot B_0 \cdot \left(1 - \exp\left(-Z\right)\right) \Big/ Z$$

where *k* and k' are constants of proportionality. In this equation, $\left(1 - \exp\left(-Z\right)\right)$ is the fraction of baits removed by all takers during the active period, and $\left(1 - \exp\left(-Z\right)\right) \Big/ Z$ is the average number of baits remaining over the course of the active period as a proportion of the initial number. If this term is the same in all areas, then survey CPUE is a consistent index of density across areas. Otherwise survey CPUE does not index density consistently across areas. Equivalently, if the fraction of baits taken is the same in all areas, then survey CPUE is a consistent index of density.

It is interesting to note that the effect of hook competition on the comparability of survey CPUE is wholly determined by the total bait removal rate *Z*. The species composition of the bait takers makes no difference. If 80% of the baits are taken in both Area X and Area Y (meaning that *Z* is the same), and the catch in Area X is all halibut and the catch in Area Y is half halibut and half dogfish, the survey CPUE's of halibut in the two areas will accurately reflect the relative densities of halibut.

Comparison of bait removal rates among areas

Figure 1 shows raw hook count data from the setline survey by area. In most areas 10-20% of the bait is recovered. The exceptions are Area 2A, where only 7% is recovered, and Area 4B, where a third of the bait is recovered. That is also true of stations on the Bering Sea edge in Areas 4A and 4D, but the overall rates for Area 4A and 4CDE are in the usual range. The recovery rate for all areas combined is 14%, which is a little low because in recent years all hooks have been counted in Area 2B while only 20% have been counted elsewhere, and the Area 2B recovery rate is 12%.

Table 1 shows the bait removal rates calculated from the raw data in Figure 1. Halibut are minor players in all areas except 2C, 3A, and 3B. The "Other" category, dominated by whatever species send back empty hooks or skins, are the major players in all areas. The last column is the ratio of the coastwide to the area-specific value of $\left(1-\exp\left(-Z\right)\right)/Z$. It is the multiplier that should be applied to each area's survey CPUE to make all of them consistent.

Variances of the correction factors were calculated by the jackknife method, leaving out one year at a time, on the grounds that year-to-year changes are the major sources of variance in survey data. The standard deviations of the correction factors were 0.05 for Area 2A, 0.02 for Areas 2B, 2C, 3A, and 3B, and 0.01 for Areas 4A, 4B, and 4CDE. So as a statistical matter they are almost all significantly different from one, but in most cases there is very little practical difference.

Discussion

While the standard catch equation performs reasonably well in predicting the timing of catches during the first few hours of soaking, it is not perfect. The rate at which baits are taken has been found to vary over time in different ways for different gears and target species, and Sigler (2000) reports substantial variation among stations. The estimate of the average number of baited hooks fishing during the active period is based on the observed proportion of bait recovered and an assumed rate of decline based on the catch equation. It is at therefore an approximation, and small differences among areas in the estimate are not reliable even though they may be statistically significant.

Hook competition is not the only possible cause of differences among areas in setline survey catchability. Differences in temperature may affect survey catchability directly or indirectly (Stoner et al. 2006). The availability of natural prey may also affect the desirability of the bait (Stoner 2004). Factors such as these are almost surely responsible for the substantial year-to-year variability of survey CPUE and may also cause some consistent differences among areas.

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Clark, W.G., and Hare, S.R. 2007. Assessment of the Pacific halibut stock at the end of 2006. Int. Pac. Halibut Comm. Report of Assessment and Research Activities 2006:97-128.

Sigler, M.F. 2000. Abundance estimation and capture of sablefish (*Anoplopoma fimbria*) by longline gear. Can. J. Fish. Aquat. Sci. 57:1270-1283.

Somerton, D.A., and Kikkawa, B.S. 1994. A stock survey technique using the time to capture individual fish on longline gear. Can. J. Fish. Aquat. Sci. 52:260-267.

Stoner, A.W. 2004. Effects of environmental variables on fish feeding ecology: implications for the performance of baited fishing gear and stock assessment. J. Fish. Biol. 65:1445-1471.

Stoner, A.W., Ottmar, M.L., and Hurst, T.P. 2006. Temperature affects activity and feeding motivation in Pacific halibut: implications for bait-dependent fishing. Fish. Res. 81:202-209.

Table 1. Bait recovery fractions, total instantaneous bait removal rates *Z*, and various species-specific removal rates F_i, by area. The last column shows the multiplier that should be applied to each area's survey CPUE to make survey CPUE a consistent index of density across areas. Except as noted below, all data from 2001-2006 were used. The "Other" category in this table includes emtpy hooks and skins.

				Instantaneous rates by species					
Area	**Stations**	**Fraction recovered**	***Z***	**Halibut**	**Cod**	**Dogfish**	**Sablefish**	**Other**	**Correction factor**
2A	504	0.07	2.66	0.06	0.00	0.09	0.21	2.30	1.25
2B	1014	0.12	2.16	0.14	0.00	0.27	0.09	1.65	1.07
2C	653	0.15	1.89	0.28	0.01	0.08	0.12	1.40	0.97
3A	2222	0.10	2.30	0.47	0.07	0.38	0.10	1.29	1.12
3B	1328	0.15	1.92	0.55	0.18	0.01	0.07	1.12	0.98
4A	664	0.18	1.70	0.23	0.24	0.00	0.03	1.20	0.91
4B	528	0.34	1.09	0.08	0.10	0.00	0.01	0.90	0.72
4D	336	0.34	1.07	0.10	0.20	0.00	0.00	0.77	0.71
4CDE*	204	0.18	1.74	0.06	0.29	0.00	0.00	1.39	0.92
EBS*	82	0.13	2.03	0.04	0.29	0.00	0.00	1.69	1.02
All	7313	0.14	1.97	0.25	0.07	0.18	0.08	1.38	1.00

* The Area 4CDE data are all stations fished in the eastern Bering Sea in 2006, including the shelf stations, island stations, 4D edge, and 4A edge. The "EBS" data are just the eastern Bering Sea shelf stations fished in 2006.

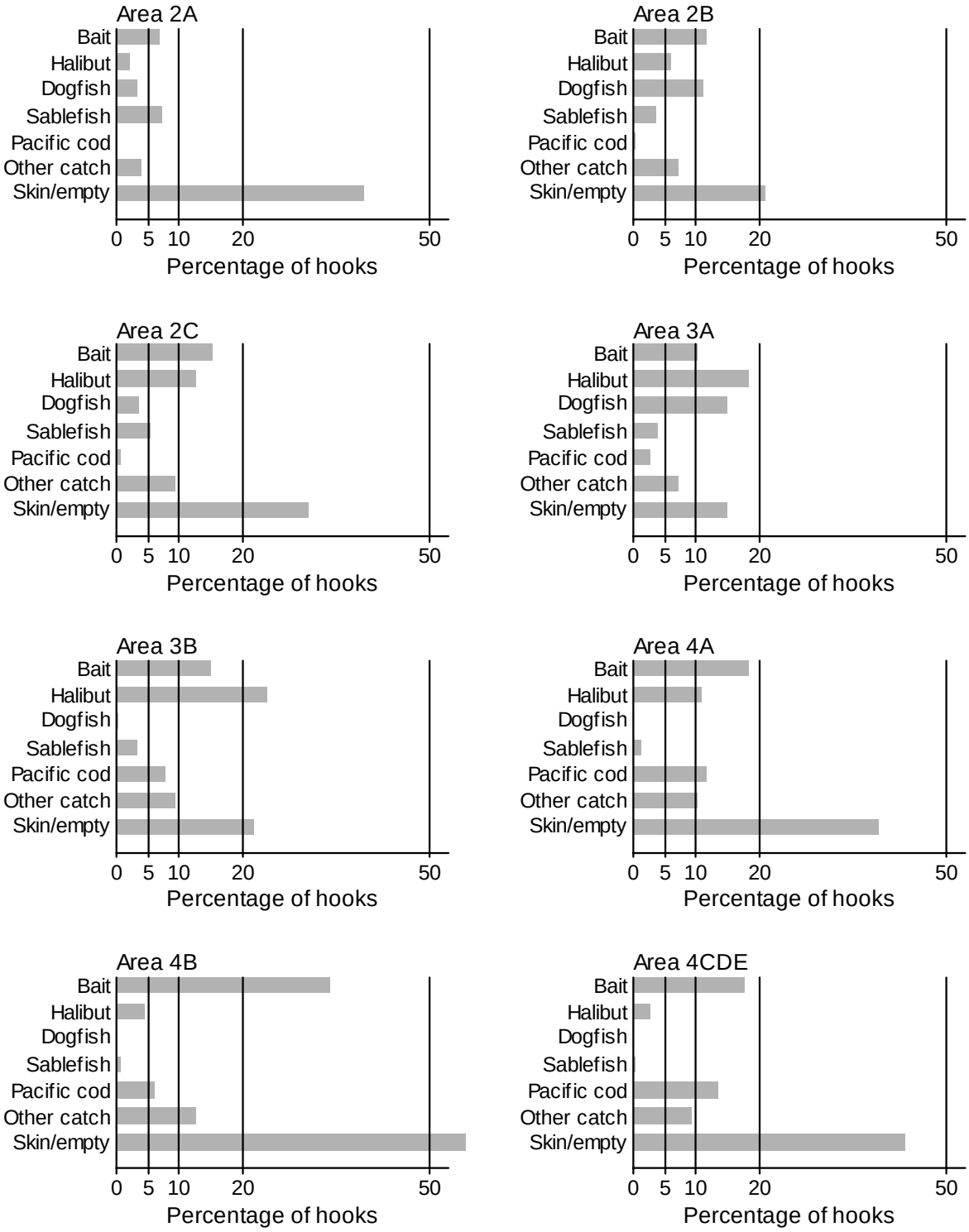

Figure 1. Survey hook contents by area, 2001-2006 data combined.

International Pacific Halibut Commission
Stock Assessment Workshop
June 27-28, 2007
Nexus Hotel
Seattle, Washington

Note: The following summarizes key points of the workshop and is not intended to be a verbatim transcript. Appended to this summary is a list of questions posed by participants and the staff responses.

Wednesday, June 27

IPHC Director, Dr. Bruce Leaman, introduced the external scientific reviewers Drs. Chris Francis and Paul Medley from the Center for Independent Experts (contracted through University of Miami), who attended the meeting as a component of an IPHC independent assessment review, and Dr. Steve Martell of UBC Fisheries Centreas moderator of the workshop.

Dr. Martell's opening remarks included recognizing that there has been a substantial change in the halibut assessment from a closed area to a coastwide approach. This workshop is being held to look at the technical details of the model, the data going into the model, and the method for apportioning the coastwide biomass into IPHC regulatory area biomass. Material concerning the 2006 assessment was made available on the IPHC website prior to the meeting (http://www.iphc.washington.edu/halcom/newsrel/2007/nr20070509.htm).

Dr. Leaman presented an overview of Pacific halibut management: (http://www.iphc.washington.edu/halcom/meetings/workshop2007/presentations/ws0701bml.pdf). Discussion of the presentation included clarification of CEY and harvest rate. There was a comment that it appears IPHC deliberates catch limits privately and that the 2007 results were a surprise to the public at the January Annual Meeting. Dr. Balsiger agreed that perhaps the Commission was not explicit enough at the public session in explaining the rationale for how it arrived at catch limits for 2007 and will try to improve in the future.

Ms. Heather Gilroy presented commercial fishery removals with no discussion following: (http://www.iphc.washington.edu/halcom/meetings/workshop2007/presentations/ws0702hg.pdf).

Mr. Gregg Williams presented other removals: (http://www.iphc.washington.edu/halcom/meetings/workshop2007/presentations/ws0703gw.pdf) There was discussion of assumed observer coverage in the Bering Sea trawl fleet and whether scientists believed that the rate of observer coverage reflected the actual percentage of the catch. It was clarified that the 30% target coverage for vessels 60-125 feet in length and 100% coverage for vessels greater than 125 feet referred to hauls made and not directed catch. Therefore, the actual catch observed could vary from the haul coverage targets. It was noted that for the stock assessment model, the current year's figures for bycatch mortality are used. For some fisheries

that is a estimated number for the entire fishery and for others it is a projection based on partial year's data.

Mr. Claude Dykstra presented setline survey information: (http://www.iphc.washington.edu/halcom/meetings/workshop2007/presentations/ws0704cd.pdf). There was discussion of the presence of commercial fishing immediately before the survey fishes on a station and how this event is taken into consideration. The NMFS sablefish survey was given as an example of a survey where commercial vessels are asked to cease fishing prior to survey fishing. The IPHC staff noted that there are many survey vessels fishing at the same time and the logistics of limiting access at these sites as the survey progresses would be prohibitive. Furthermore, the survey should reflect what is happening on the grounds and if commercial fishing lowers CPUE at certain sites, then that is the reality. Also, factoring fishing pressure into the CPUE in some fashion would be difficult.

There was significant discussion of the survey design. Some participants suggested that the systematic sampling design is not unbiased to relative abundance in certain areas. For example, the design results in lower variance in areas where the continental shelf is wider and there are more stations. However, the stations are assigned systematically, so that sampling is in proportion to the amount of bottom area, i.e., the wider the shelf, the greater number of stations. It was also noted that the survey begins at 25 fathoms and there may be some halibut in more shallow areas. The staff explained that these shallow areas have been fished before but that it is technically difficult to fish the shallows.

A discussion took place of how species composition is estimated in the survey. The staff explained that the systematic 20% hook sampling appears to represent abundance of common species fairly well, but is less precise for less common species. There have been two detailed analyses of 20% vs. 100% sampling and both concluded that the present procedures were unbiased but the precision of estimation decreased with lower occurrence of a species. It was also noted that such results occur for any subsampling scheme and are not unique to the IPHC procedure. A 100% hook count for species composition requires a third sampler and the survey vessels generally carry two samplers. The exception is in British Columbia where the commercial fishers have funded a third sampler to account fully for bycatch.

Following a short break, Dr. Ray Webster presented the PIT tag study results: (http://www.iphc.washington.edu/halcom/meetings/workshop2007/presentations/ws0705rw.pdf). Following clarification of points from the presentation, it was suggested that if harvest rates are different among areas, then this will result in a redistribution of biomass relative to proportional harvest. The staff commented that it could be happening for example in Area 2 where the harvest rate appears to be higher.

The fact that fish appear to be migrating from Areas 4A and 3B to Area 3A, but virtually no fish appear to be migrating from Area 2C to Area 3A was noted. The staff acknowledged this also and speculated that density dependence could be altering distribution, i.e., a large biomass in Area 3A is inhibiting recruitment into the area. In addition, migration on the eastern side of the stock appears to be primarily in an eastward and southward direction, where recoveries have been sufficient to establish a trend.

There was discussion of Area 4A in terms of Bering Sea side versus Gulf side. The staff noted that the halibut from the Bering shelf Closed Area likely recruit to the Bering Sea side of Area 4A.

The following suggestions were made to staff:

- to analyze whether the fishing mortality is different for the year following release of tags.
- to analyze how the Gulf side compares to the Bering Sea side of Area 4A, and also look at how many halibut actively move from the Bering Sea side to the Gulf side.

Dr. Clark presented IPHC data pre-processing practices: (http://www.iphc.washington.edu/halcom/meetings/workshop2007/presentations/ws0706bc.pdf). It was noted that processes of smoothing the data are different for survey versus commercial data. The staff agreed to revisit the topic later in the workshop. There was some discussion of sex composition and the high site fidelity of PIT tagged fish. Dr. Clark noted a study done in 2005 that looked at commercial fishing recoveries within 10 miles of PIT tag stations, and suggested that perhaps with the coastwide model, the proximity to stations should be adjusted. Also mentioned was that mean depth distribution changes from east to west but the model includes 0-300 fm depth in all areas, however staff noted that catch of halibut below 300 fm was very low (< 3%) in all areas.

The following were requests of staff:

- to look at the halibut tagged on the Gulf side of Area 4A and the resulting recovered area.
- to check depth distribution by area and resulting tag recoveries.

Following a break for lunch, Dr. Clark presented the IPHC stock assessment model: (http://www.iphc.washington.edu/halcom/meetings/workshop2007/presentations/ws0707bc.pdf). He began with a description of the basic 'vanilla' model. There was significant discussion of catchability. It was explained that the definition of catchability is the proportion of the population that will be caught with one unit of effort. In the assessment, there are different catchabilities assigned to each fishery and in the coastwide version, there is one estimated value each for males and females. Dr. Francis suggested that while using one value for the coastwide catchability for the commercial fishery is likely not a problem, it may be for the survey and that value should be allowed to fluctuate. Staff commented that commercial catchability is allowed to fluctuate in the model but survey catchability is not.

There was some discussion of natural mortality and removal accounts. It was noted that the total groundfish fishery in Area 2B is a different fishery currently than in the past, with 100% of removals in all fisheries now being accounted for. The staff agreed that the better estimates could impact results in the model and that discard mortality numbers in B.C. are much lower than in the past. Ultimately, the most influential variables in the models are the selectivities and the catchabilities.

Dr. Clark continued his presentation with fitting of the model. He noted that the model fits well with data for both females and males in the survey but are divergent with males in the commercial fishery. Several models have been tried and thus far, there are no better fits that cure

the retrospective problems. Dr. Francis suggested that instead of fixing the data outside the model, do it inside instead. In addition, fit the CPUE without a scalar at all and perhaps maybe slightly larger ones on other parameters.

Dr. Clark presented penalties and weights with little discussion.

Following a break, Dr. Clark presented alternative model fits. Following some discussion of the data being used for the alternative model fits, the staff agreed to look into reasons for the difference in male and female selectivities in the Freeform and the Smooth Ten models.

Dr. Martell reminded the attendees that the staff were trying to be open about the subjectivity that goes into the model and one purpose for this workshop is to air out that subjectivity and see how different assumptions can lead to divergent views on management outcomes.

There was some discussion of the IPHC staff's evaluation of gains and losses in the different model fits. Dr. Leaman explained that the staff does not expect to go back to closed-area assessments given the compelling evidence of migration and its estimated impacts. The IPHC Commissioners in attendance reserved judgment on this change pending this workshop and further study.

There was further discussion of closed area versus coastwide assessment models. It was pointed out that these two options were at the extremes and that there were other options in between. The staff noted that there are two separate topics, one is the assessment and the other is apportionment. Exploitation is higher in the east than in the west and the coastwide model protects the stock as a whole. There was a suggestion that PAT tags could be used to look at migration rates. The staff responded that the project is possible, but would be costly, and they had been unsuccessful at getting funding for a large PAT tag project. Dr. Francis suggested including information on migratory movements that we already have as well as what-if scenarios into the coastwide assessment model to see how the results change. The staff commented that they are confident that area assessments would be very sensitive to that information, that it is incomplete or lacking in several areas, and its use would encumber the assessment with the same problems as exist in the closed-area assessments. It was agreed that such a process could be a valuable simulation exercise but in the absence of accurate and detailed migration estimates of high precision, the model results would be largely driven by values in which we cannot place great confidence. There would also be a need to reconcile this information with the survey results. It was suggested to treat them as random effects. There was a comment that in the closed-area assessments there were declining trends in the stock that the model did not pick up, and that a better understanding of the reasons for this is crucial. A counterpoint was made that it is not a biological problem, but may be from the timing of how the fishery is executed and results may carry over into selectivity.

Dr. Martell redirected the discussion back to the alternate models. He commented that there is too much weight (and double fitting of age composition data) being put on age and he suggested downgrading the age composition and focusing further on the survey CPUE. The large effective sample sizes on the age-composition information may be one source of the retrospective bias in

the assessment model. Age composition alone does not give information on absolute abundance and that is important to remember when making allocations.

Dr. Clark presented area apportionment strategies: (http://www.iphc.washington.edu/halcom/meetings/workshop2007/presentations/ws0708bc.pdf). He noted that the declines in survey biomass indices for Areas 3B and 4 were expected given the low historical exploitation in these areas and the 'fishing down' effect of higher exploitation rates in more recent years. Concerning relative catchability among areas, he showed that the recovery rate of PIT tags per 10,000 fish scanned was similar in Areas 3A and 3B. If for instance, catchability was actually higher in an area, the expectation would be a higher recovery rate of PIT tags in that area. There was some discussion of the use of trawl data. Dr. Francis asked the staff to produce for the workshop, an estimate of absolute abundance based on trawl surveys.

A discussion of hook competition ensued. Dr. Clark conducted an analysis of hook competition among areas and noted that except for possibly Areas 2A, 4B and 4D, CPUE is consistent among areas on the survey. He examined bait competition and found that the fraction of baits recovered on survey stations is consistent across Areas 2B-4A. It was further explained by staff that some studies suggest a local depletion effect around the gear in some areas and not necessarily a loss of bait scent. It was noted that competitive interference from bycatch or other halibut could be important, but the analysis indicates that it is not a significant factor in the interpretation of survey CPUE. Dr. Richards asked if there are research projects being designed to deal with these questions. Dr. Clark concluded that setline survey CPUE appears to be a consistent index of density in Areas 2B-4A, and a case could be made for scaling upward in Areas 2A and 4B but there is no objective means to choose the appropriate scalars.

Discussion was opened to look at methods of biomass allocation among areas. It was noted that fundamentally, it is a policy decision, but that decision should be based on sound science and sustainability. Sablefish apportionment was described and it was noted that it is the goal to harvest sablefish at equal rates across the range. From a migratory standpoint, 30-40% of sablefish can move in a year and smaller individuals are more likely to migrate than larger ones.

The final discussion of the day was a summary of apportionments done by the Council for other species such as rockfish, pollock, and cod.

Thursday, June 28th

Dr. Clark presented the results of the alternative model fits that had been suggested in the last session: (http://www.iphc.washington.edu/halcom/meetings/workshop2007/presentations/ws0709bc.pdf). The major features changed were to remove any double fitting of data (catch at age but not CPUE at age; male and female catch at age but not total catch at age; total CPUE in number but not total CPUE in weight) and survey CPUE variance scalar set to one. In general, these model modifications had very little effect on either the fit of the model to the data or the resultant estimates of exploitable biomass. Discussion points included:

- the merits of allowing catchabilities for both commercial and survey CPUE to fluctuate each year and how that is distinguished from the error for each year. No conclusion was drawn and the discussion was temporarily tabled.
- the robustness of the estimation for catchability. It was noted that good aging data and a good handle on trends helps.
- the contradictory conclusions of different data sources. One trend suggests that the stock size is decreasing and the other suggests a downward trend only if selectivity has remained constant in recent years. Therefore, the two conclusions might be that there truly is a downward trend, but the other explanation might be that there are more smaller fish and a lower age composition. It was suggested that a third data source, the NMFS trawl survey in this case, may be looked at for information on incoming year classes. Staff noted that exceptionally strong cohorts are generally observed in the trawl surveys several years before their appearance in the exploitable stock. However, it was also noted that cohorts observed in Bering Sea trawl surveys may not index cohorts in the Gulf of Alaska.

Dr. Steven Hare presented the IPHC harvest policy: (http://www.iphc.washington.edu/halcom/meetings/workshop2007/presentations/ws0710sh.pdf). He concluded that it appears Area 2 is currently harvested too high and the other areas about normal. It was requested that Dr. Hare look at catchability and harvest levels at the edges of areas. Substantial discussion took place regarding coastwide versus closed-area approach at assessment. It was iterated that there are two components, the assessment itself and then the apportionment. The justification for the Commission's decision to not adopt the coastwide assessment at the 2007 Annual Meeting was made. Dr. Balsiger pointed out that the Commission was not rejecting the coastwide approach, but rather wanted to understand it better. It was further clarified that the coastwide model along with the 20% harvest rate were all part of the same package at the Annual Meeting, and when the Commission voted not to adopt the coastwide model, they by default agreed to go status quo on the harvest rates as well.

The 60% U.S./40% Canadian split policy for Area 2 catch was discussed. It was noted that the 1979 Protocol to the Halibut Convention between Canada and the United States allowed the Commission after 1981to alter that policy in light of 'pertinent information', which includes estimates of biomass distribution and available yield.

Further discussion points included:
- details of the slow up, fast down policy adopted by the Commission.
- the target versus actual harvest rate in different areas. The goal whether using the coastwide or any assessment model is to harvest all areas at the same rate. Given the survey-based apportionment, that should allow a build-up of biomass in the east where the estimated harvest rate has been substantially higher for the past several years.
- the even application of a harvest policy across all areas and transparency of management.
- the fact that, if the survey-based apportionment is correct, the high exploitation rates on the eastern side of the stock have been partially offset by migration and that is why they may have sustained higher harvest levels. However, there has been an increase in exploitation in the western areas since 1998 and the absolute number of migrants may now be lower than historically.

Dr. Hare presented how the IPHC treats bycatch and sport catch data sets in the assessment: (http://www.iphc.washington.edu/halcom/meetings/workshop2007/presentations/ws0711sh.pdf). Following a break, there was discussion of the data sets, clarification of bycatch impacts, and the types of information available. The areas of concern were limited observer coverage requirements for some fisheries in Alaska, the lack of length data for the sport fishery, and the possibility of visiting the impact of the sublegal mortality on the sector of the fishery from which it came. The issue concerning vessels in Alaska being able to choose when to take an observer and the resulting assumed observation rate was also raised.

Dr. Martell summarized the proceedings with three points:

1. There has been a radical change from the closed area to a coastwide assessment. The closed area assessment had problems with sparsity of data, conflicting data sets, and the assumption of closed populations. The rationale for adopting a coastwide approach was to avoid these problems. However, the change introduces additional assumptions; the data are aggregated and the way they are analyzed is not insensitive to potential differences in catchability in each area.
2. Regarding apportionments, right now the setline survey is used with an assumption of constant catchability among areas. Bathymetric contours are different and if the area habitats were mapped, there would likely not be good correlation of catch by depth ranges among areas. This problem needs to be groundtruthed and tagging may be a way to do that.
3. The problem now is what to do in the interim.

The floor was opened to discussion of point 3.

Dr. Jim Ianelli commented that given what was presented for migration rates, the issue of allocation does not have a strong biological basis. Many issues are outside of conservation or scientific concern. He advised that the Commission would be prudent to come up with a formula of constant allocation.

There was a recommendation that the staff blend the commercial and survey CPUE at different rates to see what happens.

Dr. Richards thanked the commission staff and the contributors to the meeting. She noted that the Commission's task will be to make policy decisions around the scientific advice. There should also be some alternate methods of apportionment explored instead of CPUE only. Forecasting is still not comfortable and looking at longer term shifts in effort and the resulting effects to achieve an optimally harvested stock, needs more work.

Dr. Balsiger agreed that the workshop was helpful in his gaining understanding of the model.

Dr. Leaman noted that there are two processes; this workshop and then the independent review. A report of the proceedings and conclusions will be worked up by staff and available around the beginning of August.

Comments on the structure and content on this and of future assessment workshops included:

- this workshop was valuable for those not trained as scientists and/or in stock assessment to better understand the process, but peer reviews (e.g. STAR panels) are also encouraged.
- Area 2A representatives suggested a meeting with staff within the next couple of months to further discuss the concepts. Area 2B representatives were also invited.
- a peer review every few years to devise pro-rated apportionments instead of having the apportionment fluctuate with survey CPUE annually.
- a recommendation for less modeling and more groundtruthing.
- a recommendation that while this meeting, with the hybrid of a peer review and industry workshop was very helpful, perhaps every other year would be enough for the future.
- urging the IPHC to continue with this type of forum and taking impacts of apportionment decisions on small communities such as in Area 2A, into consideration.
- a recommendation that all user groups including charter fleet participate in this type of process.
- a recommendation for future workshops to focus on only one or two aspects of the assessment such as migration, or the model, etc.

Dr. Leaman agreed to make the presentations available via the IPHC website and thanked the attendees and staff for their participation.

Meeting adjourned.

Attendees

IPHC staff
Bill Clark
Claude Dykstra
Heather Gilroy
Steven Hare
Tom Kong
Bruce Leaman
Tim Loher
Lauri Sadorus
Ray Webster
Gregg Williams

IPHC Commissioners
James Balsiger
Ralph Hoard
Laura Richards
Gary Robinson

Other invited participants
Steve Martell – Convener, UBC Fisheries Centre
Chris Francis – CIE External Peer Reviewer

Paul Medley – CIE External Peer Reviewer

Others

First Name	Last Name	Title	Organization/Agency
Bob	Alverson	Executive Director	Fishing Vessel Owners Assoc
Kerim	Aydin	Supr. Fishery Biologist	NMFS/AFSC
Ashleen	Benson	Ph.D. Student	Simon Fraser University
Don	Bodenmiller	Fish Biologist	ODFW
Terri	Bonnett	Halibut Coordinator	Fisheries and Oceans Canada
Dave	Carlile	Fisheries Scientist	ADF&G
Tom	Casey	Consultant	
Sean	Cox	Professor	Simon Fraser University
Nick	Delaney	Comm. Fisherman	Kodiak Vessel Owners Assoc
Yvonne	deReynier	Groundfish Branch Chief	NMFS/NWR
Jane	DiCosimo	Staff specialist	NPFMC
Martin	Dorn	Fishery Biologist	NMFS/AFSC
Sharron	Elwood	Comm. Fisherman	
Garrett	Elwood	Comm. Fisherman	
Wes	Erikson	Comm. Fisherman	HAB
Yongwen	Gao	Researcher	Makah Fisheries Management
Dana	Hanselman	Fishery Biologist	NOAA
Thomas	Helser	Fishery Biologist	
James	Ianelli	Assessment scientist	NMFS/AFSC
Tom	Jagielo	Senior Research Scientist	WDFW
Steve	Joner	Fishery Biologist	Makah Fisheries Management
Robert	Jones	Marine Biologist	NW Indian Fisheries Commission
Jacquelynne	King	Scientific Advisor	Fisheries and Oceans Canada
Linda	Kozak	Consultant	Kodiak Vessel Owners Assoc
Loh-Lee	Low	Scientific Advisor	NOAA
Sandra	Lowe	Research Fisheries Biologist	NMFS/AFSC
Joe	Macinko	Comm. Fisherman	
Charles	McCallum	Fishery Biologist	Lake and Penninsula Borough
Scott	Meyer	Fishery Biologist	ADF&G
John	Moller	Fleet Manager	Adak Fisheries
Melvin	Moon	QNR Director	Quileute National Resources
Kris	Northcut	Harvest Manager	Quileute National Resources
Peggy	Parker	Executive Director	HANA
Stan	Sargent		
Joe	Schumacker	Fishery Biologist	Quinault Indian Nation
John	Secord	Comm. Fisherman	Halibut Advisory Board
Paul	Spencer	Research Fisheries Biologist	NOAA
William	Stockhausen	Fishery Biologist	NOAA
Russell	Svec	Fishery Manager	Makah Fisheries Management
Chuck	Tracy	Staff Officer	PFMC
Theresa	Tsou	Senior Research Scientist	WDFW

Jack	Turnock	Assessment scientist	AFSC
Shizhen	Wang	Fisheries Biometrician	Quinault Indian Nation
Tom	Wilderbuer	Flatfish assessment scientist	NOAA
Mark	Wilkins	Survey manager	AFSC/RACE
Gary	Williamson	Comm. Fisherman	Delta, BC
Robert	Wurm	Comm. Fisherman	Linden, WA
Phillip	Wyman	Comm. Fisherman	AK Longline Fisherman's Assoc.

Appendix

Questions from the stock assessment workshop, June 2007

IPHC Staff

1. What portion of mark recoveries from Area 4 were released north rather than south of the Aleutian chain?

The following table shows all commercial 2003-2006 tag-recoveries from Area 4 releases by recovery area. Here Areas 4A and 4B are divided into their northern (Bering Sea: 4A.bs, 4B.bs) and southern components (Gulf of Alaska: 4A.goa, 4B.goa). The dashed horizontal and vertical lines separating the Bering Sea and Gulf of Alaska areas are to facilitate comparison of movement within and between the two large geographical regions.

	Recovery area									
Release area	**2B**	**2C**	**3A**	**3B**	**4A.goa**	**4B.goa**	**4A.bs**	**4B.bs**	**4C**	**4D**
4A.goa	8	7	11	6	12	1	1	0	0	0
4B.goa	1	1	0	0	0	4	0	0	0	0
4A.bs	1	0	2	0	1	1	14	1	1	0
4B.bs	0	0	1	0	0	0	0	1	0	0
4D	1	0	1	0	0	0	1	0	0	15

		Recovery area									
Release		bs → bs				bs → goa					
area	**No. rel.**	**4D**	**4C**	**4B.bs**	**4A.bs**	**4B.goa**	**4A.goa**	**3B**	**3A**	**2C**	**2B**
4D	979	15	0	0	1	0	0	0	1	0	1
4B.bs	347	0	0	1	0	0	0	0	1	0	0
4A.bs	1285	0	1	1	14	1	1	0	2	0	1
4B.goa	789	0	0	0	0	4	0	0	0	1	1
4A.goa	2171	0	0	0	1	1	12	6	11	7	8
		goa → bs				goa → goa					

Only one fish released in the Gulf side of Area 4 was recovered in the Bering Sea, a 4A fish that stayed in 4A. Five (out of 21 recovered) 4A Bering Sea releases crossed to the other side of the islands. One (of two) 4B Bering Sea fish moved out of the Bering Sea (showing up over in 3A), along with two out of 18 Area 4D fish (one went to Area 3A and one to Area 2B). These numbers do not account for recovery rates or scanning rates, but they appear to indicate that the majority of the fish tagged and released in the Bering Sea has stayed in the Bering Sea, although there is clearly enough transfer to avoid any genetic segregation of Bering Sea and Gulf of Alaska fish.

2. Does depth distribution of halibut vary from east to west?

Figure 1, shown at the workshop, shows the relationship between depth and survey CPUE in each area for the years 2001-2006. The plots show the depth effect from a generalized additive model fit in which year was a factor and depth was a smooth term. Using peak CPUE as a measure of distribution, halibut are distributed with peak abundance occurring between about 75-150 in the eastern portion of the stock but extending down to about 200 fm for the western areas (Area 3B and westward). However, in all areas the range of significant halibut abundance, as well as catch by the commercial fleet, is covered by the distribution of survey stations from 25-275 fm.

3. Does the estimated sampling variance of the commercial catch at age/sex include the variance of the proportion female estimated with the fitted logistics?

Yes; the standard multinomial variance based on sample size is scaled up by 1.05^2 to incorporate a 5% coefficient of variation of the estimated proportion female.

4. What does the site fidelity seen in survey recoveries of PIT tags mean for the mark-recapture analysis?

Last year 83 PIT tagged fish were recovered on the setline survey, with 66 of these (around 80%) recovered on the survey station on which they were released. These raw recovery data imply a high degree of site-fidelity of tagged fish, and potentially that tagged fish do not mix well with the untagged population, at least during the summer months when the survey fishing (and tagging) occurs. As almost all recoveries come from commercial fishing, poor mixing will be a problem if there is a mismatch between tag-release locations and commercial fishing locations and this segregation persists throughout the year, even if the fish move off the survey locations. If this is true, on average, an individual tagged fish will be less likely to be recovered than an untagged fish, and the resulting low recovery rates will lead to negatively biased estimates of rates of commercial fishing mortality from the tag-recovery modeling. Preliminary analysis shows some evidence for a mismatch of the distribution of commercial catch location and tag-releases. However, we note that the setline survey recoveries may be misleading, in that fish that are not on or near a station at the time of the survey are less likely to be recovered, and so the true degree of site fidelity is likely to be overestimated from the raw survey data. More detailed examination of these data and the effect of poor mixing of tagged and untagged populations are ongoing.

5. Should the weighting of survey data in the model be time and area invariant or should there be both temporally- and spatially-dependent weighting terms?

This question may have arisen out of some misunderstanding. The coastwide survey CPUE is presently calculated by weighting the area-specific CPUE by bottom area, and calculating a CPUE for each year independently, so this is already being done.

6. Why does the survey apportionment procedure use a 3-year running mean of survey CPUE rather than e.g. a 5-year forward-weighted average?

We have used an unweighted 3-year running mean for doing survey apportionment among several IPHC regulatory areas since the mid-1990s. Adding years makes the running mean more susceptible to bias resulting from trends in the CPUE series if the trends among areas are

different, which they clearly are. Forward weighting increases the variance of the running mean. We conducted trials with various options and found the 3-year running mean performed well in terms of bias and variance for trends up to 10% per year. It is stable in practice, too. The estimated area apportionments for the last ten years (Fig. 2) change over time but in a gradual fashion.

7. Can NMFS trawl survey data be used to check for differences in setline survey catchability among areas? How do you know that trawl survey catchability doesn't vary among areas, too?

Trawl survey catchability of halibut definitely varies among areas. It is clearly low in areas with a lot of rough bottom, like 2C and 4B. But between Areas 3A and 3B, where there is a broad, mostly trawlable shelf, there seems little reason to suspect a trawl survey catchability difference. The lack of coincident trawl and setline surveys, conducted with the same fishing gear in all areas, precludes a stock-wide comparison.

8. Do we have enough observations of incoming cohorts to try to estimate them? Are noisy observations of these age groups causing the retrospective pattern?

The first few estimates of incoming cohorts are always noisy, but that in itself should not produce a retrospective pattern.

9. Can the model reliably distinguish between strong incoming recruitment and high mortality of fully recruited fish?

Yes; the stock assessment estimates total mortality by tracking individual cohorts through the fishery, not by examining the age composition in a single year.

10. Some data are fitted more than once, e.g. the survey catch at age/sex and the survey CPUE at age/sex and the total survey CPUE? Isn't that redundant?

Yes, it is. In principle the catch at age/sex and the total CPUE contain all the information, and the CPUE at age/sex could be left out of the fit. Or the model could be fitted just to the survey CPUE at age/sex. But those non-redundant fits are different from each other because the data contain variance. Fitting to all three datasets requires the fit to track cohorts as well as fitting the catch at age and the total CPUE, which are all good things.

At the workshop the model was fitted with no redundancy and there was no effect on the biomass estimates.

11. Were the variance scalars estimated with raw rather than robust deviations?

Yes. In the coastwide data set there are very few outliers so as a practical matter this is not an important issue.

12. Were variance scalars estimated for all data types or only for catch at age/sex?

For all data types. The table below, shown at the workshop, has the working values of tau for each data type. The variance scalar is tau squared. The values of tau are mostly 2-3, meaning that sampling variance accounts for a quarter or less of the total variance of the observations about the model predictions. The remainder is process error and model specification error. The generally good fits of the parsimonious production model indicate that the model structure is appropriate, so most of the variance is process error.

	Females	Males	Total
Commercial catch at age	3.0	2.4	3.5
Commercial CPUE at age	3.1	2.6	3.7
Commercial total CPUE in number			1.6
Commercial total CPUE in weight			1.9
Survey age composition	1.3	1.3	1.6
Survey CPUE at age	2.5	2.6	2.9
Survey total CPUE in number			2.6
Survey total CPUE in weight			2.3

13. Are the biomass outputs calculated using the estimated true age composition and the estimated size at true age?

No. Those calculations use the observed size at the observed age. So, for example in a year with surface age readings, the spawning population in number at true age is calculated and then the corresponding surface age distribution is predicted by smearing the ages, and those numbers at each surface age are multiplied by the observed weight at each surface age to calculate the spawning biomass.

14. The survey apportionment of the estimated coastwide biomass among areas depends critically on survey catchability being equal in all areas. How can that be ground-truthed?

Lacking some independent, indisputable measure of relative density, it is impossible to know whether survey catchability is the same in all areas. It certainly varies among years, so it may well vary among areas within years. Because the survey apportionment is based on a 3-year running mean CPUE, the important question is whether the average survey catchability varies among areas. At the workshop the staff presented some analysis that at least failed to show any difference among areas:

(i) Trawl and setline survey data, although variable, produce similar estimates of relative abundance in Areas 3A, 3B, and 4A where the bottom is mostly trawlable.

(ii) The incidence of PIT tags in commercial landings (tags/10,000 fish scanned) is very similar in Areas 2B, 3A, and 3B, although higher in Area 2C. One would expect a lower incidence of PIT tag recoveries in areas where the survey catchability is lower, because a lower proportion of the stock would have been marked and released on the survey.

(iii) Analysis of survey hook occupancy data indicates that the competition by other species for baited hooks is similar in Areas 2B, 2C, 3A, 3B, and 4A (higher in 2A and lower in 4B and 4D).

15. When the model is fitted, equal weight is given to the catch at age and CPUE data. Why not put more weight on the survey CPUE when that is regarded as the most reliable indicator of stock trends?

Survey and commercial CPUE were given extra weight in some previous assessments, including the closed-area fits that were standard though 2006, because the fits were poor in some areas and extra weight was needed to achieve a satisfactory degree of agreement with the CPUE data. The coastwide fit agrees well with the CPUE series with no extra weight. It is generally good practice to avoid ad hoc weighting, so in the production model all of the weights were set to one. At the workshop several models were fitted in which the weight on the survey CPUE was increased by a factor of 4. The fits to the survey CPUE were nearly indistinguishable from the production model, and the biomass estimates were almost the same. The conclusion was that the unweighted model fits the CPUE data very well.

16. Survey apportionment is based on bottom area from 0 to 300 fm, but the survey only covers 20-275 fm. Would the proportions be different if the survey depth range were used?

New (and old) estimates of bottom area (in square nautical miles) between specified depth contours for all IPHC regulatory areas are presented in the following table. For each area, the percent of the coastwide total is also given. The Area 4A-BS (for Bering Sea) and 4D edge estimates both use 75 fathoms as the shallow contour (instead of 0 or 20 fathoms). The details of the computations are given in a report to be published in the 2008 RARA. A draft of the report may be obtained at http://www.iphc.washington.edu/staff/hare/html/papers/bottom_area.doc. Briefly, the new estimates are derived from a high resolution digital bathymetry dataset while the old estimates derived from hand tracing on NOAA charts.

	20-275 fathoms		0-300 fathoms		0-500 fathoms		0-300 fm. (old)	
Reg. area	N mi^2	%	N mi^2	%	N mi^2	%	N mi^2	%
2A	10561	4.1	13117	4.0	15304	4.4	12000	4.1
2B	22552	8.8	31695	9.7	33237	9.5	28000	9.5
2C	10064	3.9	16316	5.0	17137	4.9	15000	5.1
3A	42871	16.7	50872	15.5	52550	15.1	50000	16.8
3B	23735	9.3	30621	9.3	32289	9.3	30000	10.3
4A-GOA	8929	3.5	10914	3.3	12961	3.7	19000	6.3
4A-BS	7417	2.9	7736	2.4	9057	2.6		
4B	11892	4.6	15411	4.7	23286	6.7	16000	5.5
4D edge	12162	4.7	12405	3.8	13867	4.0	5000	1.7
4CDE shelf	106030	41.4	138670	42.0	138670	29.8	120000	40.7
Total	256213	100.0	327758	100.0	348359	100.0	295000	100.0

The improved digital bathymetry files used as a basis for the 0-300 fm calculations result in more bottom area in Area 4D (at the expense of the Area 4CDE shelf) but relatively small changes (~1%) for other areas. Using only the 20-275 fm range would result in more substantial changes. While the IPHC survey does not extend into any areas shallow of 20 fm, we know from commercial records that catches in these shallower areas are not insignificant: between 3 and 7% in most areas and around 50% in Areas 4C and 4D, thus it would be prudent to include these depths. Conversely, catches from deeper than 300 fm are small: 1% in areas 2A and 3A, 4% in Area 4A and less than 1% in all other areas.

17. At the workshop, the staff showed the ratio of setline survey to trawl survey CPUE at length and claimed that the data showed no difference among Areas 3A, 3B, and 4A. But there did appear to be some differences.

The data clearly showed that the ratio of setline to trawl CPUE in Area 3B was neither 2-3 times what it was in Area 3A nor was it consistently higher in Area 3B, which were the important points in considering whether the closed-area assessments were credible. Similarly, Area 4A shows higher ratios for smaller fish but the same ratios as Area 3A for larger fish. The staff is doing a more detailed comparison of trawl survey and setline survey data.

18. The staff presented GAM estimates of the relationship between depth and survey CPUE but there were no error bars. How precise are those estimates?

Figure 1 shows the fits replotted with 95% confidence intervals.

19. The depth-stratified mean CPUE is the same as the simple mean in all areas except 2A, but in view of the difference there, is there any reason not to compute a depth-stratified mean in all areas?

Not in principle. In practice there might be some confusion about different CPUE series appearing in different places but it is reasonable to use depth-stratified means to accommodate any depth effect. The data suggest that while the effect may not be large, it is not equivalent among areas (Fig. 1)

20. Will the change from closed-area assessments to a coastwide assessment with survey apportionment have a significant effect on capital values?

The estimates of coastwide abundance from the two procedures are about the same, but survey estimate of biomass in Area 2 is only about 15% of the coastwide total, whereas Area 2 has been receiving about 30% of the coastwide total according to the closed-area assessments. A complete implementation of proportional harvest according to the survey apportionment would therefore reduce the yield associated with Area 2 shares by about half, with yield for shares in Area 3B and 4 increasing in value. However, we also estimate that the use of a constant harvest rate policy in all areas would result in an increase of biomass in the eastern portion of the stock, so that the current decreased proportion of the stock in the eastern portion would be only a transitory effect of a survey-based apportionment. Historically, changes in yield associated with shares do not have a direct relationship with capital value because of the change in ex-vessel price per pound that may accompany any changes in yield per share. Increases or decreases in ex-vessel price per pound associated with supply and demand can act to offset changes in yield per share.

21. What apportionment methods other than the survey method could be used?

The setline survey data are the best information available for estimating the distribution of biomass among areas. Trawl survey data would be a possibility if we had comparable data in all areas, but we do not now and never will, because some areas like 2C and 4B are untrawlable. Commercial CPUE is available for all areas, but the comparison of commercial and survey CPUE shows that commercial catchability varies greatly among areas. Commercial CPUE is ten times survey CPUE in Area 2A, about three times in Area 2B, about the same in Area 2C, and so on. These differences do not result from differences in survey catchability; they result from the fishery targeting good grounds more or less effectively while the survey covers the whole area.

The staff has examined several other methods of apportionment, including the historical recruitment distribution as estimated by the closed-area assessments and historical fishery shares. However, none of these other metrics for apportionment incorporates the objective standardization of the survey metric. Historical recruitment estimates are subject to the same errors resulting from migration as the closed area assessments. Historical fishery shares reflect the distribution of fishing effort and are subject to severe biases resulting from the distribution of fishing effort. Using survey data for apportionment is not perfect, as we have noted, but it represents the most objective measure currently available.

Over the long term, we believe yield should be distributed among areas in proportion to biomass. Proportional harvest is standard practice in fishery management for good reasons. It protects the stock against disproportionate harvest of sensitive sub-components of the stock (e.g. behavioral groupings), about which there may be little or no knowledge, but departures can and do occur. The Commission has temporarily assigned catch limits that resulted in non-target harvest rates when there have been significant changes in either assessment methodologies or harvest policies, as a transition to new harvest regimes. However, it now appears that a disproportionate share of the halibut yield has been taken in Area 2 for some time resulting in very high exploitation rates and lower biomass than would result from harvesting at the target rate.

22. How about estimating biomass distribution using a mixture of survey and commercial CPUE?

The IPHC staff had considerable discussion on this proposal. The strongest objection to using commercial data for apportioning biomass is that the raw data consistently show strong differences in commercial and survey catchabilities among areas. The ratio of the two indices varies from 0.48 – 0.99 among areas and is consistent within areas, over time. Introducing commercial data into the apportionment process will embed these biases. However, it can be argued that incorporating some consideration of the commercial data could offset any temporal bias inherent in the survey data, which are collected over only a short portion of the year in each area. On balance, the strongly biased relationship of commercial and survey data convinces the staff to decline the use of commercial data for this purpose.

23. Will an apportionment of yield based on stock distribution at the time of the survey really achieve proportional harvest when fish migrate before, during, and after the survey?

Yes. The concern here is that if we estimate the correct stock distribution at the beginning of the year and allocate yield accordingly, it will be necessary to fish a lot harder in source areas of migration than in destination areas to catch the quotas, because fish will be leaving the source areas and entering the destination areas during the year. That line of reasoning is correct, but the disparity in fishing mortality rates that would result is small.

With a survey apportionment, we do not estimate stock distribution at the beginning of the year but in the middle of the year. Results of emigration and immigration are therefore reflected in survey CPUE, and the rate of fishing mortality is the same in all areas. A full analysis of these effects is posted at http://www.iphc.washington.edu/halcom/research/sa/papers/proportional.pdf.

24. The last three years of data in both closed-area and coastwide fits show declining CPUE that is not fitted well. What's the problem?

The coastwide fit actually tracks survey and commercial CPUE quite well, including the last three years. It is true, however, that survey catchability declined in 2005 and again in 2006. We can see this in model fits where the rate of fishing mortality in 2006 is fixed at various levels and the corresponding series of survey and commercial catchabilities are estimated year by year. In all cases survey catchability is seen to be quite variable among years and to decline in 2005 and 2006.

25. What is the desired distribution of spawning biomass? Will proportional harvest achieve that distribution, or should it modified in some way?

Absent other compelling information, the desired distribution of spawning biomass would be something akin to its distribution absent fishing. Simulation modeling across a range of fishing and migration rates was conducted and reported in the 2007 RARA. The results showed that proportional harvest, i.e., the same constant harvest in all regulatory areas maintained nearly the same spawning biomass distribution as in the unfished state. The unbalanced harvest rates we now believe to have been in effect for at least the past decade – 50% of the target rate in the western areas and 150-200% in the eastern areas – leads to a substantial change in the distribution of spawning biomass. Specifically, the contribution of the eastern areas to the distribution is greatly decreased. At an annual migration rate of 0.06 and instantaneous fishing mortalities in the range of 0.20-0.30, the contribution of areas 2B and 2C to the spawning biomass change from 44% in an unfished state to an equilibrium value of 23-26% when the above described unbalanced harvest rates are applied.

26. To what extent is migration influenced by fishing? In particular, are we seeing migration from west to east because higher exploitation in the east has reduced densities there and created openings for migrants?

The question of density-dependent exclusions has not been investigated for large-scale population distributions. Certainly, studies of territorial fish in both tropical and temperate climates show dominance-based hierarchies of occupation of prime feeding or breeding habitats. The evidence of site fidelity seen in recoveries of PIT-tagged halibut from survey stations provides the potential for such a spatially-explicit behavioral process in halibut. The ubiquity of competitive exclusion as a biological process in populations suggests that higher densities of halibut repetitively occupying the same spatial niches would result in shifts in recruitment patterns relative to periods of lower population densities. Densities of halibut in the central Gulf of Alaska have been at record levels over the past decade, also evidenced by lower growth rates. In conjunction with higher exploitation rates in the eastern portion of the stock, it is reasonable to expect that migration to this eastern region may be higher than it would be under either conditions of lower density in the central Gulf, or lower exploitation rates in Area 2.

27. The survey apportionment assumes that halibut habitat is the same proportion of total bottom area in all areas. Is that true?

The survey apportionment makes no assumption about halibut habitat, which is not well defined in any case. The only assumption about habitat involved in the apportionment is that the survey samples each habitat in proportion to its presence. Survey stations are distributed uniformly in all areas, so they can be expected to sample different kinds of habitat in proportion to their occurrence in each area. An area consisting entirely of good habitat will produce a high

CPUE at all stations and therefore a high average CPUE. An area consisting of half good habitat and half poor habitat will produce a high CPUE at half the stations and a low CPUE at half the stations, so its average CPUE will be much lower than that of the good area. Habitat differences are therefore reflected in survey CPUE.

28. How about developing a model with explicit migration in which all of the area-specific data are fitted with area-specific parameters?

Such a model would obviously be the ideal way to accommodate movement of fish. However, it is critically dependent on precise knowledge of the rates of migration by all sizes of fish, at all times, among all areas. Further, if there were any temporal or biomass dependence in such rates, they would have to be estimated continuously. This would be a very large project that would present a number of significant technical difficulties, but the main drawback is that we would not be able to estimate the migration rates internally and the results would depend entirely on what rates we assigned externally. Given the evident difficulties in generating reliable estimates for all sizes of fish, it is highly unlikely that these rates could be known with precision sufficient for making catch limit recommendations.

29. The Commission should recognize that allocation is not a purely biological issue and deal with it by developing an allocation framework that considers both biological and policy issues.

The Commission does recognize that allocation is a subsequent process to biomass estimation. It has traditionally based catch limits on proportional harvest of the estimated biomass for each area. While alternate policy-based allocation formulae are possible, the staff believes that they would have to be consistent with the sustainable yield of the stock and, if the formulae were to have an equitable basis, then they would have to be consistent with the sustainable yield for each regulatory area as well. The staff does not believe such a policy-based approach will be functional unless it has this sustainable basis.

Existing policy-based allocation formulae (e.g. the allocative Catch Sharing Plan (CSP) of the Pacific Fishery Management Council for Area 2A) are implemented after the conservation (sustainability) decision has already been made (i.e., the CSP works entirely within the catch limit adopted external to the CSP). Ultimately, conservation and allocation can be separated but in the hierarchy of decisions, conservation and sustainability must be paramount.

30. How is sublegal bycatch accounted for in CEY calculations?

Total CEY (Constant Exploitation Yield) is calculated by applying a target harvest rate (presently 20%) to estimated exploitable biomass. Fishery CEY in each area (commercial catch in all areas, plus sport catch in Areas 2A and 2B) is calculated by subtracting from total CEY all other removals that are similar to commercial removals in their effect on the stock. These consist of all hook-and-line catches, legal-sized as well as sublegal, and all legal-sized bycatch.

Currently, sublegal bycatch in the trawl fishery is treated differently because it is mainly of fish with a modal length around 50 cm. The effect of these removals on the stock is some years off, and the geographic distribution of the impact is uncertain because migration rates and schedules are unknown. We can calculate that sublegal bycatch at present levels reduces coastwide recruitment at age 8 by 10%, and we include this level of pre-recruit mortality in the fishery simulations that we conduct when evaluating alternative target harvest rates. It turns out

that the choice of a target harvest rate is not very sensitive to the level of pre-recruit mortality, but in principle a reduction in sublegal bycatch mortality would increase both recruitment to the stock and total CEY.

Another option is for sublegal bycatch mortality in the halibut setline fisheries to be deducted directly from the CEY for the areas in which it occurs because almost all of it is close to the commercial size limit and, therefore, the impact on total yield to the stock is essentially equivalent to the impact of catching those fish somewhat later in time as legal-sized fish.. To implement such an accounting process would require annual estimates of sublegal size composition in all setline fisheries, as well as mortality rate estimates for the discards by each gear. Comprehensive treatment of this mortality would also require estimation of discards within the recreational fishery, which are substantial in some areas such as Area 3A. Such information does not presently exist and the current process of accounting for such mortality in the setline fishery through harvest rate adjustment is appropriate.

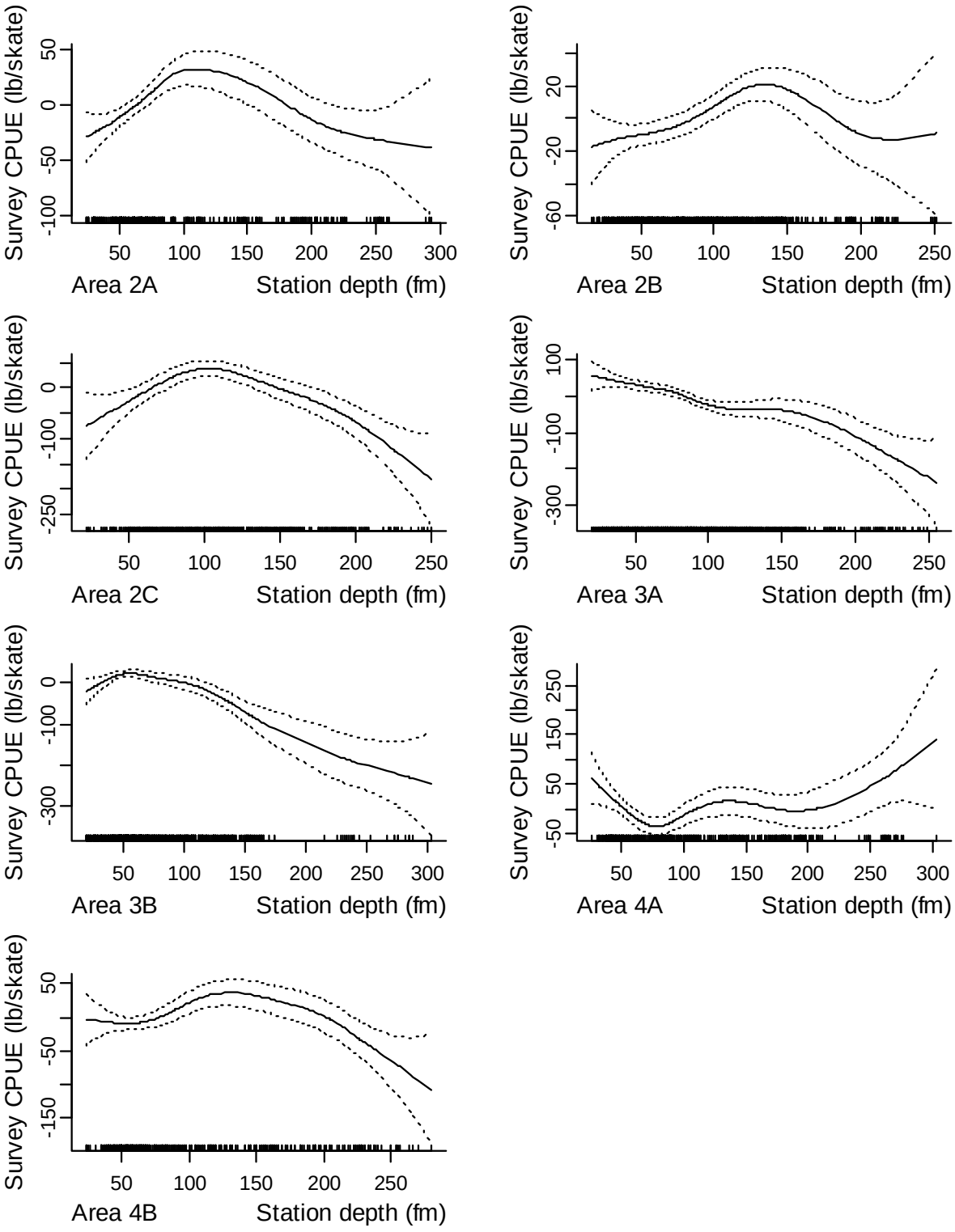

Figure 1. Relationship between depth and survey CPUE, from a GAM model fit (for survey years 2001-2006). The dotted lines show 95% confidence intervals. The ticks on the bottom axis show data points.

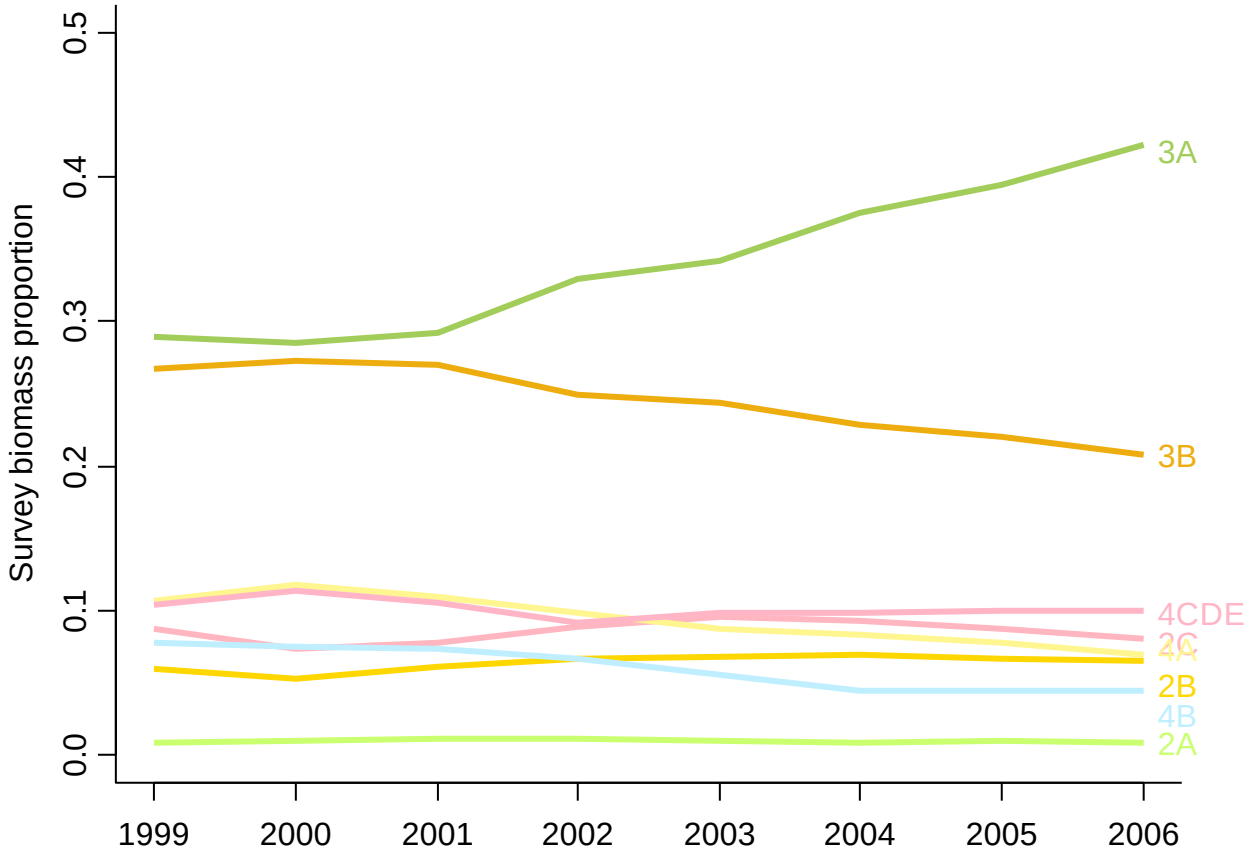

Figure 2. Estimated proportion of exploitable biomass in each area as estimated from bottom area and a 3-year running mean of survey CPUE.

Agenda Item H.3.b
Supplemental GAP Report
September 2007

GROUNDFISH ADVISORY SUBPANEL REPORT ON PACIFIC HALIBUT STOCK ASSESSMENT

Mr. Chuck Tracy provided a review of the June 27-28th, 2007, meeting hosted by the International Pacific Halibut Commission (IPHC) regarding their new stock assessment and area allocations. The IPHC has an annual meeting in November regarding stock assessment issues and recommendations. The Groundfish Advisory Subpanel (GAP) requests that the Council discuss with the IPHC the possibility of having the November meeting open to the public. Currently the November meeting is closed to the general public except for agency personnel.

The new IPHC stock assessment proposal tends to shift harvest from the Eastern regulatory areas to the Western regulatory areas. The allowed harvest levels for each individual subarea with the new assessment are not based on the relative biology of the individual subareas. The harvest amounts are proposed to be determined based on a coast wide analysis and subsequent apportionment. The GAP is concerned that this new assessment shorts the harvest potential of Area 2A. Area 2A agency personnel attending the November meeting are requested to help protect area 2A from new and questionable allocation formulas.

PFMC
09/14/07

SCIENTIFIC AND STATISTICAL COMMITTEE REPORT ON PACIFIC HALIBUT BYCATCH ESTIMATE FOR INTERNATIONAL PACIFIC HALIBUT COMMISSION

The International Pacific Halibut Commission (IPHC) held a stock assessment workshop June 27-28, 2007. Three members of the Scientific and Statistical Committee (SSC) attended the workshop (Dr. Martin Dorn, Dr. Thomas Helser, and Mr. Tom Jagielo). The SSC expresses its strong support for this type of workshop and commends the IPHC for facilitating a greater understanding of their stock assessments and stock assessment process. However, this type of workshop does not provide a forum for the type of independent review that takes place during a Stock Assessment Review (STAR) Panel.

The SSC was not in a position to conduct a formal review of the Pacific halibut assessment. However, the following comments are intended to inform the Council about some key elements in the assessment.

1. There is more uncertainty in the assessment than is explicitly acknowledged in the assessment document.

2. There is evidence that survey catchability is not the same in all areas. This may be particularly true in Areas 2A relative to other areas. Area 2A survey catch per unit of effort (CPUE) could be weighted by depth to help alleviate this issue.

3. The Pacific halibut assessment has moved from a multi-area assessment to a single area assessment to better account for the evidence of movement of fish. The overall estimate of biomass is largely invariant to the choice of modeling frameworks. Although these frameworks represent the bounding conditions on movement (i.e., no movement and complete mixing), the truth is between these bounds. The IPHC has expressed their intention to investigate the explicit modeling of fish movement in future assessment work. The SSC agrees that this is an important area of research.

4. Given that the choice of a multi-area or single area assessment does not affect the overall biomass estimate, its main effect is distributional.

5. The IPHC assessments do not contain terms of reference. If the IPHC wishes to continue external review, terms of reference for the process would be helpful.

PFMC
09/13/07