FISKIRANNSÓKNARSTOVAN

VIÐGERÐ AV ÁRSFUNDINUM HJÁ ICES Í 1990

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INNIHALDSYVIRLIT

INNGANGUR

Ein týdningarmikil táttur í arbeiðinum hjá Fiskirannsóknarstovuni er samstarvið innan Altjóða Havrannsóknarráðið ICES (International Council for the Exploration of the Sea). Á hvørjum ári í oktober er ársfundurin hjá hesum felagsskapi, har nýggjastu kanningarúrslit, ætlanir og tilráðingar verða løgd fram. Í ár (1990) varð fundurin hildin í Keypmannahavn, har ICES eisini hevur høvuðssæti, og á fundinum, sum var frá 3. til 9. oktober, vóru næstan 300 ritgerðir og frágreiðingar lagdar fram. Umleið 400 granskarar vóru á fundinum.

Samlað yvirlit og tvítøk av øllum greinum, sum vórðu lagdar fram, eru á Fiskirannsóknarstovuni, og vit hava roynt við hesum riti heilt stutt at draga tær greinir fram, sum serliga kunnu hava áhuga hjá føroyingum; ikki so at vit endurgeva tær í síni heild; men í staðin so, at vit greiða frá høvuðsinnihaldinum. Tey, sum hava hug at lesa alla greinina ella aðrar greinir, sum vit ikki nevna, eru vælkomin út á lesistovu okkara.

Arbeiðið innan ICES er býtt sundur í tvær ráðgevandi nevndir og 12 vísindaligar nevndir. Tær ráðgevandi nevndirnar eru ACFM (Advisory Committee on Fishery Management), sum ger tilráðingar viðvíkjandi stovnsrøkt og ACMP (Advisory Committee on Marine Pollution), sum ger tilráðingar viðvíkjandi dálking av havinum. Tær 12 vísindaligu nevndirnar viðgera ymiskar tættir innan hav- og fiskifrøði. Tær eru:

B	Fish Capture Committee	viðger fiskihættir og ekkóloddkanningar
C	Hydrography Committee	viðger havrannsóknir
D	Statistics Committee	viðger roknihættir innan fiskifrøði
E	Marine Environmental Quality Com.	viðger havumhvørvi og dálking
F	Mariculture Committee	viðger havbúnað
G	Demersal Fish Committee	viðger botnfisk
H	Pelagic Fish Committee	viðger flotfisk
J	Baltic Fish Committee	viðger Eystursjógvin
K	Shellfish Committee	viðger botndjór
L	Biological Oceanography Committee	viðger æti og gróður
M	Anadromous and Catadromous Fish Com.	viðger laks og tílíkan fisk
N	Marine Mammals Committee	viðger havsúgdjór

Tey ymsu ritini, sum verða løgd fram á fundinum, verða viðgjørd í einari (viðhvørt fleiri) av nevndunum, og tey eru merkt við einum stavi, sum vísir til nevndina. Hetta eru teir stavir, sum eru vístir framman fyri hvørja nevnd í yvirlitinum. Síðan eru greinirnar talmerktar. Greinin *C:3* er sostatt triðja greinin í Hydrographic Committee.

Í restini av hesum riti hava vit drigið fram nakrar høvuðsspurningar, sum vit halda hava serligan áhuga. Í viðgerðini vísa vit til samandráttir (abstract) av teimum greinum, vit hava hildið havt mestan áhuga, og hesir samandráttir eru savnaðir aftast í ritinum og skipaðir í bókstavarøð eftir hvørji nevnd, teir hoyra til. Afturat teimum fundum, sum vóru hildnir í teimum ymsu ráðgevandi og vísindaligu nevndunum, var eitt Minisymposium um árin á botndjór í Norðsjónum, og samandráttir frá tí eru eisini við.

RÁÐGEVING

Ein týðandi partur av arbeiðnum hjá ICES er at geva limalondunum ráð um, hvussu tey eiga at troyta fiskastovnarnar í komandi árum. Til hetta endamál eru arbeiðsbólkar, ið á hvørjum ári viðgera støðuna í stovnunum út frá tilfari savnað inn av fiskirannsóknarstovum.

Fyri Føroyar eru tað serliga arbeiðsbólkurin fyri stovnarnar í útnorði (*Assess:20*), ið hevur ághuga. Hesin viðger botnfiskastovnarnar tosk, hýsu og upsa undir Føroyum, upsa undir Íslandi, kongafisk, blálongu og svartkalva undir Føroyum og Íslandi. Men eisini arbeiðsbólkarnir, ið viðgera svartkjaft (*Assess:3*), atlantoskandiska sild og lodnu (*Assess:5*), makrel (*Assess:19*), laks (*Assess:11*) og eisini arbeiðsbólkurin, ið viðger stovnarnar í Barentshavinum (*Assess:4*), hevur okkara stóra ághuga.

Frágreiðingarnar og niðurstøðurnar hjá arbeiðsbólkunum verða viðgjørdar av ráðgevandi nevndini viðvíkjandi stovnsrøkt (ACFM), ið síðan kemur við endaligu tilráðingini frá ICES (Reports of the Advicory Committee on Fishery Management, 1989, Cooperative Research Report 168).

Bæði fiskifrøðingar og tey, ið umsita fiskiskapin, eru viðhvørt ójøvn á máli um, hvørja tilráðing ICES skal geva. Summi lond og samtøkur av londum vilja helst, at ICES kemur við einum tali fyri mest loyvdu veiðu í nøgd (Total Allowable Catch, stytt TAC) av einum fiskastovni komandi ár ella tvey komandi árini. Onnur lond vilja heldur hava, at tilráðingin er ein veiða í nøgd innan ávís trygg lívfrøðilig mark.

Seinri mátin loyvir fiskivinnuumsitingunum betur at stýra fiskiskapinum við atliti bæði at støðuni í stovnunum, t.d. støddd á gýtingarstovni og tilgongd, og støðuni í vinnuni. Øll eru samd um í prinsippinum, at hesin mátin er tann beinasti; men tey, ið heldur vilja hava fyrra mátan, vísa á, at myndugleikarnir (politikkararnir), um teir hava eitt val millum tvær veiðinøgdir, at kalla altíð velja hægsta talið og oftast meira, og at tað tí er uttan meining at geva tvey tøl. Fiskifrøðingarnir eru tí noyddir at spæla politikkarar.

Drúgt orðaskifti var um hetta á ársfundinum. Til dømis hevði Føroya Landsstýri skrivað til ICES og fýlst á, at ráðgevingin fyri stovnarnar undir Føroyum var tilvildarlig og ikki fylgdi seinra mátanum nevndur omanfyri. Av fyrilestrum undir hesum orðaskifti kann eisini nevnast greinin *H:21* við heitinum *The choice of target fishing mortality in herring fisheries.*

VEÐURLAGSBROYTINGAR OG FISKASTOVNAR

Veðurlagsbroytingar, sum stava frá mannaávum, fara ivaleyst at broyta lívikorini hjá fólki komandi øldina, og nógvir vísindaligir felagsskapir hava tikið henda spurning upp sum ein tann týdningarmesta í sínum arbeiði. ICES hevur leingi verið við í hesum arbeiði á ávísum økjum; men lítið er gjørt við spurningin um, hvørja ávirkan veðurlagsbroytingarnar fara at hava á fiskastovnarnar. Hetta er tó ein upplagdur spurningur hjá ICES at viðgera, og hetta var ein tann mest umrøddi spurningurin á fundinum í ár.

Ikki vóru nógvar greinir, sum høvdu beinleiðis úrslit. Eitt undantak var *C:36*, har kannað varð, hvussu ymisk fiskasløg sambært yvirlitstrolingum í 21 ár hava flutt seg suður ella norðureftir fram við Norðuramerikansku Eysturstrondini samanborið við hitabroytingar hesi somu árini. Kanningin viðgjørdi 36 ymisk fiskasløg, og úrslitini benda á, at tey kunnu býtast í nakrar bólkar, sum skikka sær ymiskt mótvegis hitabroytingum.

Ein onnur áhugaverd grein var *G:49*, sum viðgjørdi vøkstur av ymsum fiskasløgum í Barentshavinum sum yngul, t.v.s. fyrsta árið, og samanbar vøksturin m.a. við hitan í sjónum.

Í greini *G:24*, varð eitt modell lagt fram, sum vísti, hvussu vøksturin hjá fiski í miðal er ávirkaður av stovnsstøddini og hitanum niðri við botnin. Útrokningarnar vórðu gjørdar viðvíkjandi 7 toskastovnum í NAFO-økinum (t.e. í vestara parti av Norðuratlantshavinum). Niðurstøðan var greið; vísast kundi, at bæði stovnsstødd og hitin í sjónum hava munandi ávirkan á, hvussu fiskur veksur. Størri stovnur og kaldari sjógvur minka um vøksturin. Víst varð á, at tá ein stovnur er niðurundirkomin og roynt verður at menna hann aftur, kann væntast, at vøksturin verður minni, so hvørt sum stovnurin gerst størri.

Í eini aðrari grein, *G:25*, varð umframt stovnsstødd og hitan í sjónum kannað, hvørja ávirkan støddin á lodnustovninum í NAFO-økinum 2J3KL ávirkaði vøksturin av toski í sama øki. Við sama modelli, sum víst er á omanfyri, varð komið til, at lodnustovnurin ikki kann sigast at hava ávirkan á vøksturin av toski í hesum økinum.

Frá Fiskirannsóknarstovuni høvdu vit eina grein um tosk og hýsu undir Føroyum, sum fyri part nært við henda spurning (*G:33*). Úrslitini í hesi grein verða nærri viðgjørd í einum komandi riti í røðini: *Fiskirannsóknir*, og vit viðgera hana ikki nærri her; men skulu bert nevna eitt av úrslitunum, sum er, at veðurlagsbroytingarnar væntandi fara at hava ymiska ávirkan á tosk og hýsu undir Føroyum. Toskurin tykist vera nógv minni viðbrekin enn hýsan; helst tí, at hann tað fyrsta árið heldur seg nærri landi og er minni merktur av skiftandi veðurlagi.

Eitt tað mest áhugaverda í hesum sambandi eru tó tær ætlanir, sum eru um samskipaðar kanningar. Hesar fara serliga at snúgva seg um ávirkanina av veðurlagsbroytingum á tosk undir heitinum: *A Study of Cod and Climate Changes*. Fyribils frágreiðing (*G:50*) frá tí bólki, sum fyriskipar hesar kanningar, varð løgd fram, og semja var um at leggja stóran dent á hesa ætlan. Fiskirannsóknarstovan er við í hesi kanningarætlan, sum fevnir um allar toskastovnar í Norðuratlantshavi, eisini tosk undir Føroyum.

HAVRANNSÓKNIR FRÁ FYLGISVEINUM

Tað eru longu nógv ár síðan, at farið varð undir mátingar av havinum frá fylgisveinum (Remote Sensing), og nógvar mátingar eru gjørdar, eisini í okkara sjógvi. Torført hevur tó verið at fáa hendur á mátingunum, og tær einastu mátingar, sum hava verið nakað nýttar her hjá okkum, eru hitamátingar frá fylgisveini. Arbeitt verður við at gera heimsumfatandi yvirlit, sum kunnu gera tilfarið lættari at koma til (*C:37*).

Aðrastaðni hevur eisini nógvur áhugi verið fyri úrslitum frá *the Coastal Zone Colour Scanner* (CZCS), sum frá fylgisveini mátar litin í sjónum, og við tí sigur nógv um gróðurin. Kunnleikin til gróður í føroyskum sjógvi er lítil, so stór nytta hevði verið av hesum mátingum hjá okkum; men tær hava ikki verið atkomiligar. Nú er arbeiðið at gera eitt nýtiligt yvirlit farið í gongd innan ESA (European Space Agency), og sambært *C:41* kunnu vit kanska rokna við at fáa nýtiliga vitan frá hesum um eini tvey ár.

DÁLKING AV NORÐSJÓNUM, SKAGERRAK OG KATTEGAT

Dálkingin av Norðsjónum hevur í fleiri ár verið ein spurningur, sum hevur stóran almennan og politiskan áhuga. ICES er ráðgevi fyri stjórnir og millumtjóða dálkingarkonventiónir, og hesin spurningur hevur verið nógv viðgjørdur innan ICES á teimum seinastu ársfundunum. Skiljast kann millum tveir høvuðsspurningar.

Eutrofieringin av Norðsjónum er tað, sum hendir, tá tøðevni verða førd út í havið og økja um gróðurin. Í sjálvum sær ger hetta ikki skaða, tvørturímóti vil onkur halda, men um illa vil til, kann økti gróðurin taka so nógva ilt úr sjónum, tá hann rotnar, at ov lítið verður eftir til fiskar og botndjór at anda, hetta nevnist *hypoxia*. Greinirnar *Mini:5, E:4* og *E:6* lýsa úrslit av kanningum í økjum, har ilttrot hevur verið, og gera samanberingar við sjúkueyðkenni hjá fiski í hesum økjum. Mesta ávirkanin av eutrofiering hevur, sum væntandi var, verið nær landi, og nógv tjak hevur verið, um opnu partarnir av Norðsjónum eru eutrofieraðir. Frágreiðingin frá einum arbeiðsbólki innan *Shelf Seas Oceanography* (*C:8*) gevur eitt yvirlit yvir náttúrligar og mannaskaptar keldur til tøðevni í Norðsjónum og viðger eisini gamlar mátingar av tøðevnisnøgd, og kemur til tað niðurstøðu, at hóast týðiligur vøkstur er í Eysturssjónum, í Kattegat og Skagerrak og fram við strandaøkjunum í Norðsjónum, so eru hesar mátingar so óálítandi, at torført er at gera av, um vøkstur hevur verið í opnu pørtunum av Norðsjónum. Ikki var full semja um hesa niðurstøðu (*C:7*).

Dálking við eitrandi evnum er hin høvuðsspurningurin í Norðsjónum. Hesi evni eru serliga olja, ymisk tungmetal og ymisk organisk dálkingarevni. Greinin *Mini:7* viðger ávirkan frá oljuframleiðslu til havs, og greinin *E:22* lýsti kanningar av tungmetalum, serliga blýggi og cadmium, í botnsedimenti og botndjórum. Í hesi grein varð nevnt, at nøgdirnar á Dogger Bank eru serliga høgar, og hetta hevur áhuga í sambandi við eina aðra grein, *Mini:3*, sum samanbar teljingar av botndjórum á Dogger Bank í 1950-54 við nýggjari teljingar í 1985-87. Samanberingin vísir hampuliga stóran mun, sum høvundin setir í samband við eutrofiering og dálking. Semja var tó ikki á fundinum um hesa niðurstøðu.

Sambandið millum dálking og fiskasjúkur í Norðsjónum varð eisini viðgjørt meiri alment á fundinum, *E:11*.

VISTFRØÐI HJÁ BOTNDÝRUM Í NORÐSJÓNUM

Ein arbeiðsbólkur er innan ICES, ið viðger vistfrøðina hjá botndýrum í Norðsjónum. Úrslit frá hesum arbeiðsbólki vórðu løgd fram á einum sonevndum "Mini-Symposium", har eisini árin á botndýrini av dálking (sí aðrastaðni í hesi frágreiðing) og fiskireiðskapi varð tikið fram.

Greinirnar *Mini:1, 2, 8, 9, 10* viðgera útbreiðsluna av botndýrunum, og hvat ið er avmarkandi fyri útbreiðsluna.

Nógv hevur verið tosað um, hvat árin troling hevur á havbotnin og tað lív, ið er har. Tíverri viðgjørdi bert tann eina greinin (*Mini:11*) hetta evnið, og var tað fiskiskapur við bummtroli, ið ikki verður nýtt undir Føroyum. Niðurstøðan var, at í minsta lagi 6 cm av botninum varð grópaður upp av trolinum, og djóralívið broyttist heilt nógv eftir troling; bert fá av teimum djórasløgum, ið vórðu kastað útaftur, vóru før fyri at liva víðari, men flestu dýr, ið vórðu sílað út gjøgnum meskarnar, livdu víðari. Dentur varð tó lagdur á, at beinleiðis samanberingar eiga ikki at verða gjørdar við aðrar árstíðir og onnur øki.

"TROFISK MODELL"

Ein sonevnd "poster-sessión" var um modellering av vistskipanum við virðum fyri framleiðslu og biomassum á teimum einstøku trofisku stigunum og effektiviteti í orkunýtslu frá einum stigi til tað næsta.

Ein áhugaverd grein ella "postari" *L:46*, viðgjørdi sambandið millum "detritus cyklus" og framleiðsluviðurskiftini í sjónum yvirhøvur. Sera áhugavert var, at útrokningar vísa, at upptøkan av ólívrunnum køvievni (nitrogen) hjá mikroverum í sjónum (bakterium) um summarið helst er líka stór, sum plantuæti tekur upp, og hetta vil aftur siga, at ein stórur partur av tí ólívrunna køvievninum á henda hátt verður óatkomandi fyri plantuætið.

FØÐI OG SODNING HJÁ FISKI

Seinastu árini eru royndir gjørdar at fara frá teimum vanligu sonevndu "einstovns-stovnsmetingunum" og yvir til "fleirstovna-stovnsmetingar", har fleiri stovnar verða mettir samstundis; sera týðandi í hesum sambandi er at fáa at vita, hvat tey ymsu fiskasløgini liva av, og hvussu nógv tey eta. Hetta verður vanliga gjørt við magakanningum, har magainnihaldið verður skilt sundur í sløg og vigað og mátað. Fyri at kunna nýta hesar kanningar til at siga, hvussu nógv toskur etur um árið, er neyðugt at vita, hvussu ofta toskurin etur, og hvussu skjótt tey ymsu føðievnini sodnast. Stórar óvissur og ósemjur hava verið um hesi viðurskifti.

Semja tykist tó vera um, at hiti, stødd á ránsfiski, stødd á máltíð og slag av føði eru avgerandi fyri, hvussu nógv av føði verður tikið upp í maganum og sodning, men hvussu langa tíð sodningin tekur er enn ikki vissa fingin fyri, og tað er sera avgerandi fyri at meta um, hvussu nógv fiskur etur (t.d. *G:51* og *G:69*).

Í sambandi við innsavning av magum, viðger greinin *G:35*, trupulleikarnar av, at fiskar eta í trolinum, og *G:3*, vísir á, at tað er týdningarmikið at savna magar inn frá ymiskum fiskireiðskapum. Grundað á kanningar við botntroli og við flótitroli í Barentshavinum, vísti *G:3* eisini á, at føðin og nøgdin av føði í maganum var øðrvísi hjá toski niðri við botn enn hjá toski uppi í sjónum. Føðin kann verða ymisk, alt eftir hvussu harður ella bleytur botnurin er, har fiskur stendur (*G:45*). Til tess at fáa eina greiða mynd av hvussu nógv ein fiskastovnur etur av øðrum fiski, er neyðugt at hava holla vitan um útbreiðsluna av fiskastovnunum eftir dýpi og botni umframt sjálvsagt, hvat og hvussu nógv verður etið á teimum ymisku dýpunum og botnunum.

GÝTING - ROGN - KLEKING - LARVUR - YNGUL

Nógv áhugavert varð lagt fram um hesi evni, m.a. greinin *L:100*, ið fyri tað mesta viðgjørdi sambandið millum tað tíðina, tá meginparturin av "Arcto-Norsku" toskalarvunum byrja at eta, og tá meginparturin av føðini hjá teimum - "copepod-naupliur" - verða klaktar. Sera týdningarmikið er hjá fiskalarvum og -yngli at fáa nóg nógva føði, tí so eru tær førar fyri at vaksa skjótt gjøgnum hesa "kritisku" tíð. Greinirnar *L:98*, *L:99* vísa á, hvussu til ber at gera av, hvussu væl fyri larvur og yngul eru viðvíkjandi føði.

Eitt av úrslitunum frá yngulkanningunum undir Føroyum er, at samband tykist vera millum vøkstur hjá toska- og hýsuyngli, og kundi hetta týtt uppá, at tað eru tey somu viðurskiftini, ið ávirka vøksturin hjá hesum báðum sløgum, meðan tey sum larvur og yngul eru uppi í sjónum. Í greinini *G:49* hava teir funnið samband millum vøksturin hjá toska-, hýsu-, silda- og lodnuyngli í Barentshavinum 1965-89, og samband tykist vera millum vøkstur av yngli og hitaviðurskiftini í sjónum.

ÚRTØKA VIÐ YMISKUM FISKIREIÐSKAPUM

Í Føroyum eins og aðrastaðni verður nógv tosað um, hvat er best hóskandi - lína ella trol. Í greinini *G:32* verður spurningurin tikin upp í sambandi við veiðu av Kyrrahavstoski. Eyðkent fyri hesa veiðu er, at trolið tekur munandi meira av smáfiski enn línan. Verða framskrivingar av veiðuni gjørdar, um ávikavist lína ella trol eigur at verða nýtt, og koma teir m.a. fram til, at 1) um ynskt verður, at stovnurin er støðugur ár undan ári, so verður veiðan í vekt hægri við línu, 2) við somu veiðunøgd fiskar línan eldri og fiskaetandi fisk, sum aftur hevði bøtt um tilgongdina, um predatión er avgerandi fyri tilgongd og 3) linuveiða kann verða loyvd, eftir at TAC fyri trolarar er nátt.

Hetta kann tó ikki beinleiðis førast yvir á føroysk viðurskifti, tí undir Føroyum er støddarbýtið í veiðuni tikin við ymiskum reiðskapum øðrvísi enn í Kyrrahavinum.

YVIRLITSTROLINGAR

Yvirlitstrolingar verða gjørdar víða um í Norðuratlantshavi, m. a. eisini undir Føroyum. Hesar miða ímóti at fáa tøl fyri, hvussu stórir teir einstøku árgangirnir í fiskastovnunum eru umframt at fáa upplýsingar um tilgongdina til stovnarnar. Í hesum kanningunum verður sama slag trol brúkt hvørt tóv ár um ár. Ein av fortreytunum fyri at fáa álítandi úrslit er, at trolið so væl sum møguligt fiskar alt, sum fyri er. Tí verður smámeskað net brúkt í posanum, vanliga 40 mm, men ymiskur atburður hjá fiski mótvegis trolinum ger, at eitt trol ikki altið fiskar teir ymisku partarnar av einum stovni líka.

Norskir fiskifrøðingar hava í nøkur ár havt varhugan av, at í teirra yvirlitstrolingum í Barentshavinum hevur lutfalsliga lítil partur av tí smáa toskinum og tí smáu hýsuni, sum eru fyri trolinum, verið fiskaður. Royndir hava tí verið gjørdar við øðrum trolum, har serliga grunnurin var broyttur, og í grein *G:55* verða úrslit frá hesum kanningum løgd fram. Tey vísa týðuliga, at hetta nýggja trolið fiskar smáan tosk og smáa hýsu munandi betur enn tað gamla trolið, hóast bæði hava somu meskavídd. Á henda hátt meta teir seg vera betur førar fyri at meta um tann yngra partin av toska- og hýsustovnunum í Barentshavinum.

REIÐSKAPKANNINGAR - FISKIHÆTTIR

Tá ið yvirlitstrolingar verða gjørdar fyri at meta um ein stovn, t.d. toskin undir Føroyum, er avgerandi at feilurin í úrslitinum er so lítil sum gjørligt. Í greinini *B:3* var ein kelda kannað, ið kann ávirka úrslitið, nevniliga frástøðan millum báðar lemmarnar, tá togað verður á grunnum vatni og á djúpari vatni. Roynt var at hava somu frástøðu uttan mun til dýpi við at geva meira og minni út av wire.

Greinin *B:28* greiðir frá úrslitunum av eini selektiónskanning, har netið í tí eina brókaposanum varð fest eftir leggi í millumstykkið (kvadratmeskar), meðan hin posin var vanligur; meskavíddin var tann sama í báðum brókunum. Meskarnir standa meira opnir, tá ið netið verður fest eftir leggi við tí úrsliti, at tann smærri fiskurin (í hesum føri síld) verður sílaður nógv betur út gjøgnum meskarnar í hesari brókini enn í hinari vanligu brókini.

Agn, gjørt úr makrelfarsi og stappað niður í ein lítlan "nylon" posa, var evni í *B:39*. Komið var fram til, at hetta tilgjørda agni, evna so tað hevur fiskaskap, ikki fiskar betur enn, um tað hevði annað skap. Hetta kemur av, at toskur vanliga etur nógv ymisk djór, og tí er

ikki skapið avgerandi fyri, um hann bítur á ella ikki.

Russar og norðmenn hava gjørt selektiónskanningar fyri at samanbera toskatrolini hjá tí norska og tí russiska trolaraflotanum í Barentshavinum (*B:51*). Úrslitini vísa, at tann russiski posin sílar nakað betur enn tann norski posin (t.v.s. at støddin á fiskinum, sum sleppur út ígjøgnum meskarnar í posanum, er eitt sindur størri), samstundis sum selektiónskurvan er brattari (t.v.s. at longdarstrekkið, ið skilir fisk, sum sleppur út úr meskunum, og fisk, sum ikki sleppur út, er smalari).

Ein áhugaverd grein (*B:46*) samanber tvey toskatrol við vanligum 135 mm posa, men í tí eina posanum er leys-línan (lace) skift út við taifun. Vanliga er leys-línan líka long ella heldur longri enn longdin á tí strekta posanum, men í posanum við taifun-leysi var línan innsett 15%. Hetta førir við sær, at taifun-línan verður tann berandi parturin, tá fiskur kemur í, og ikki posin. Posin hongur tá meira slakkur, við tí úrsliti, at meskarnir standa meira opnir, enn um posin tók alla kraftina. Sostatt sílar hesin posin betur, og munurin svarar til eina øking í meskavíddini frá 135 mm til 150 mm í einum vanligum posa.

Í bólkinum, ið viðger fiskihættir, hevur greinin *B:47* helst stóran áhuga fyri føroyingar. Hon vísir nevniliga, hvussu sleppast kann undan hjáveiðu í rækjuveiðuni. Ein stálramma við tættum rimum (rist) er fest inni í millumstykkinum framman fyri posan, hon er fest í niðaru plátuna og sett á skák aftureftir og síðani fest í ovaru plátuna. Eitt hol er skorið í nettakið beint frammanfyri, har ramman er fest í erva fyri at lata fisk, ið ikki sleppur aftur ígjøgnum ristina, sleppa út úr trolinum. Rimarnar eru so tættar (16 mm), at einans rækja sleppur ígjøgnum tær og aftur í posan. Kanningarnar eru gjørdar við einum fjarstýrdum sjókaga á 100 favna dýpi í Norðurnoregi. Tað vísir seg, at ristin ikki tarnar vanliga arbeiðinum og handfaringini av trolinum á dekkinum, eiheldur eru trupulleikar, tá ið ristin fer upp á netatrumluna. Tað skal tó viðmerkjast, at ein missur umleið 5% av rækjunum, og tað er helst tann størsta rækjan, ið sleppur. Úrslitið av hesum royndum førdi við sær, at norðmenn avgjørdu at rækjutrolararnir, ið fiska innan fyri norska sjómarkið, skulu nýta hesa rist frá 1. mars 1990.

AKUSTIKK - EKKÓLODDKANNINGAR

Ein bólkur innan ICES arbeiðir við ekkóloddkanningum og fiskihættum; úr hesum bólki skulu fyrst kanningarnar við ekkótólum viðgerast.

Í greinini *B:2*, varð roynt at máta, hvussu nógv ekkóið minkar, tá ið siglt verður yvir ein tættan sildastima, við at samanbera styrkina frá ekkónum av havbotninum á ekkóloddinum, tá eingin fiskur er undir, og tá stimi er undir. Tað skal ein rættiliga tættur og stórur stimi standa undir skipinum, áðrenn ekkóstyrkin minkar í stóran mun niður ígjøgnum stiman, soleiðis at fiskur, ið stendur longur niðri, ikki sæst.

Tá ekkóloddkanningar verða gjørdar av svartkjafti, er tað av alstórum týdningi, at ekkóið ella ljóðstrálan røkkur so langt niður í sjógvin sum gjørligt fyri at fáa so nógv av fiski við, sum til ber. Í ringum veðri verður luft ofta sligin inn undir skipið, orsakað av at skipið rullar og høggur. Henda luftin kemur fyri ekkóloddið undir skipinum, soleiðis at tað verður blokkerað við tí úrsliti, at einki sæst á ekkóloddinum. Men í greinini *B:31* varð loysn funnin á hesum trupulleika við at festa ekkóloddbotnin í endan á einum stabiliseringskjøli, ið kundi skjótast niður úr tí vanliga kjølinum á einum kanadiskum fiskirannsóknarskipi. Í ringum veðri eru tveir fyrimunir við hesi skipan: 1) tá ið kjølurin er niðri, rullar skipið minni og 2) tann luftin, ið verður sligin undir skipið, forðar ikki ekkóloddinum, sum nú situr í endanum á

kjølinum undir luftbløðrunum. Tískil kunnu ekkóloddkanningar eisini fara fram í rættiliga ringum veðri.

Í greinini *B:38* var hugt eftir, hvussu stimar av sild, makreli og brislingi bóru seg at, tá ið eitt skip nærkaðist teimum. Hetta varð gjørt við einum sokallaðum "true motion sonar" (Simrad SM 600 asdic), ið bæði plottar kósina hjá skipinum og hjá stimanum, umframt at trol og lemmar eisini síggjast á skerminum. Tað vísti seg, at ferðin á stimanum var størri, har miðallongdin á fiskinum var størri; eisini sást, at stimarnir helst fóru beint undan kósini á skipinum í fyrstani, men fóru ofta í annað borðið, tá skipið nærkaðist. Ein triðingur av stimunum vóru ikki raktir, tá ið skipið royndi at sigla yvir teimum og fáa teir á ekkóloddið. Tað hevði ført við sær, at um ein stovnsmeting av sild við ekkóloddkanningum varð gjørd, hevði úrslitið verið ein triðing ov lítið.

SILD

Ein bólkur innan ICES viðger flotfiskar burturav, og úr hesum bólki skulu tær mest áhugaverdu greinirnar um sild, svartkjaft og lodnu umrøðast.

Kanningar av sildastovni, ið heldur til innast í Balsfjord í Norðurnoregi, vístu, at henda sildin, sjálvt um hon stavar frá ti Atlanto-Skandisku sildini, í nógvum førum skilir seg frá sínum upphavi (*H:30*). Hon gýtir í sjóvarmálanum og niður á 3 m dýpi, og gýtir hon einans á tara, har eggini festa seg. Henda sildin gýtir norðuri á 70 °N, har hitin í sjónum er ímillum -0.2 °C og 1.3 °C og saltnøgdin liggur ímillum 27.2-32.4 ‰ Tað vísir, at hon líkist mest sildini í Hvítahavinum (White Sea, USSR).

Ein týðandi táttur innan stovnsmeting av sild er gransking av tilgongdini av ungsild (1-3 ára gomul sild). Greinin *H:6* viðgjørdi tílíkar kanningar í Norðsjónum, har úrslitini av altjóðayvirlitstrolingunum eftir ungsild frá 1982-1990 vóru kannað á ein matematiskan hátt (General Linear Model). Tað vísti seg, at munur var á øllum parametrum, ið vóru kannaðir (t.e. luttakandi bátur, dagur/nátt, dýpi og øki); serliga áhugavert var, at einstakir bátar (les lond) einans fiska ein sættapart av tí nøgdini, sum bátar úr øðrum londum fingu.

Fiskirannsóknarstovan legði fram úrslitini frá kanningunum av sildini, ið hevður verið at sæð undir Føroyum (*H:34*). Fiskirannsóknarskipið *Magnus Heinason* var úti og kannaði økið sunnan- og eystanfyri Føroyar í juni mánaða í ár (1990). Nógv var at siggja, serliga á Sandoyarbanka og eystarlaga á Munkagrunninum. Nótabátarnir fingu tilsamans gott 6.500 tons av sild á føroyskum øki í ár. Hetta var stór sild (4 pr. kg) búnandi til gýtingar, og stavar hon frá økinum rundan um Hetland og Orkney-oyggjarnar (Norðsjóvarsild), har hon gýtir í aug./sept. Hetta er sostatt ikki Norðhavssild ella tann Atlantoskandiska sildin, sum hvarv seinast í 60'unum. Úrslitini verða annars nærri viðgjørd í einum komandi riti í røðini: *Fiskirannsóknir*.

SVARTKJAFTUR

Fleiri greinir viðgjørdu svartkjaft í Norðuratlanshavi. Útbreiðsla, ferðamynstur og vøkstur var evni í *H:14*, har m.a. tað broytta ferðamynstrið hjá svartkjafti varð viðgjørt. Tað var serliga tann minkandi nøgdin av svartkjafti norðanfyri um summarið, samstundis sum tað sýnist, at gýtingarstovnurin vestanfyri Skotland og Írland er í vøkstri.

Lívfrøðiligar kanningar av svartkjafti var evni í *H:15*, har fiskadeyði og náttúrudeyði

(t.e. deyði, ið ikki stendst av fiskiskapi) vórðu kannað.

Greinirnar *H:8*, *H:38* og *H:39* viðgjørdu allar stovnsmetingar av svartkjafti vestanfyri Írland og Skotland, meðan *H:11* metti um svartkjaft uttan fyri 200 fjórðinga markið vestanfyri Írland og um kongafisk í Irmingerhavinum, eisini uttan fyri fiskimark íslendinga.

Ein føroysk grein (*H:33*) viðgjørdi úrslitini av ekkóloddkanningum av svartkjafti norðanfyri Føroyar í 1988 og í 1989. Nevnast kann, at árgangurin frá 1989 varð mettur at vera góður.

Tá stovnsmetingar verða gjørdar, verða sýnislutir tiknir av viðkomandi fiskaslagi, harímillum verða nytrurnar tiknar til at aldursgreina fiskin. Í hesum sambandi viðger greinin *H:37* eina tílíka aldursgreining, har nytrur úr svartkjafti, ið er fiskaður í Biskaya, vórðu sendar runt til ymisk lond, eisini Føroyar, at lesa. Síðani vórðu úrslitini av aldurslesingini frá teimum ymisku londunum samanborin, og vísti tað seg, at føroyingar saman við russum lósu fiskin 1-3 ár eldri enn norðmenn, men at spaniólar og portugisarar lógu mitt ímillum.

LODNA

Sum kunnugt hvarv lodnan í Barentshavinum í 1984-1985. Umframt av fiskiskapi kom hetta av, at nógv lodna varð etin av tí vaksandi toskastovninum í Barentshavinum. Greinin *H:16* gevur eina meting av, hvussu nógv tons av lodnu verða etin av einari ávísari stovnsstødd av toski, grundað á kanningar av, hvussu skjótt lodna sodnast í maganum á toski. Hetta arbeiði er ein partur av teimum sokallaðu fleirstovnakanningunum av m.a. toski, lodnu og rækju, sum norskir fiskifrøðingar gera í Barentshavinum.

LAKSUR

Innan laksaaling hevur tað leingi verið roynt at finna fram til meira nágreiniligar mátar at meta um, hvussu nógv fóður eigur at verða givið, og serliga nær nóg mikið er givið. Greinin *F:7* vísti á, at tað ber til at nýta ekkólodd at máta fóðurnøgdina, sum ikki verður etin, tá ið givið verður. Hetta hevur stóran týdning innan alivinnuna, tí tá kann verða hildið uppat at geva, tá ið tað sæst, at tann størra nøgdin av tí, sum givið verður, ikki verður etin, og á tann hátt kann dálkingin frá alibrúkunum minkast, samstundis sum fóðurnýtslan minkar.

Ein onnur grein *F:8*, hevði ein frymil (modell), sum simulerði tær týdningarmestu alisfrøðiligu, evnisfrøðiligu og lívfrøðiligu gerðir (processir), ið ávirka súrevnisnýtslu og útskiljing av skarni í einum aliringi.

Ein orðalisti (á enskum) við lívfrøðiligum og tekniskum orðum av týdningi fyri alivinnuna var lagdur fram (*F:21*). Endamálið við einum tílíkum orðalista er at fáa eina greiða lýsing av hesum orðum, sum verða brúkt víða um í alivinnuni.

Hvussu umhvørvið ávirkar vøksturin í ymiskum alibrúkum, var evnið í *F:35*. Hitin, saltnøgd, súrevni og ammonium vórðu mátað á 5 ymiskum alibrúkum í 4 ár. Eisini mátaðu tey hesi evni á einum staði, har eingin aling var. Tað var munur á øllum hesum parametrum á teimum ymisku alibrúkunum, men tað vóru ikki teir, sum ávirkaðu vøksturin á laksinum á teimum ymisku alibrúkunum mest. Tann besti vøksturin var ikki á tí alibrúkinum, ið var best fyri umhvørvisliga. Niðurstøðan var, at røktin og fóðringin hevur størsta týdningin fyri vøkstur á einum alibrúki.

Ein áhugaverd grein var um at nýta sjálvdeyðan laks og burturkast frá tøku av laksi til

súrløgu at blanda í fóður til laks (*F:50*). Niðurstøðan var, at bakteriurnar, ið elva til sjúkurnar furunkolosu, BKD og reyðmunnsjúku, doyðu í súrløguni, men at virus, ið elvir til IPN sjúkuna, ikki doyði í súrløguni. Tískil er ikki ráðiligt at nýta sjálvdeyðan laks og burturkast frá tøku av laksi til súrløgu at blanda í laksafóður.

Ávirkanin av ilttilseting á vøkstur av laksayngli var umrøddur í *F:63*. Tað var víst á, at um ilt verður sett til, veksur fiskurin betur. Greinin *F:64* vísti á sambandið millum dygd á smolti og ilttilseting í vatnið. Tað smoltið, sum hevði gingið í vatni við nógvari ilt í, vaks betur, tá ið tað kom á sjógv, enn tað smoltið, sum hevði gingið í vatni við lítlari ilt. Greinin *M:17*, frá Fiskirannsóknarstovuni, vísti á, at tað ber til at máta, hvussu nógv smoltið lætnar, tá tað fer á sjógv, og síðan nýta hetta sum eitt tekin um góðsku. Ein fiskur, sum er smoltifiseraður, lætnar minni enn ein, sum ikki er smoltifiseraður, tá ið teir verða koyrdir á sjógv. Ein onnur grein frá Fiskirannsóknarstovuni var um rognakanningar (*F:33*), har rogn undan alilaksi, havbitslaksi og villlaksi var kannað og samanborið. Rogn undan villlaksi hevði munandi lægri fellið enn rogn undan alilaksi og havbitslaksi. Í byrjunarfóðringini var fellið minni fyri yngul undan villlaksi og havbitslaksi í mun til fellið fyri yngul undan alilaksi. Henda greinin kemur seinri í *Fiskirannsóknir*.

KALVI

Sum nýggjur alifiskur, hevur kalvi verið granskingarevni í nógv ár. Ikki er komið á mál enn. Úrslitini frá einum parti av teirri gransking, ið er innan kalvaaling, varð løgd fram á ICES fundinum. Tvær greinir (*F:73* og *F:53*) viðgjørdu, nær farið verður at fóðra kalvayngul. Niðurstøðan var, at yngulin eigur at vera millum 200-240 døgnstig (t.e. 42-54 dagar við hita ímillum 4-5 stig), tá ið fóðringin byrjar.

Ein samanbering av vøkstri og fellið av kalvayngli, ið hevði fingið ávikavist zooplankton og ríkað *artemia* til byrjunarfóður, var gjørd í greinini *F:60*. Vøksturin var nógv betri og fellið nógv lægri í teimum bólkunum, sum fingu zooplankton. Greinin *F:61* var um at geva phytoplankton til byrjunarfóðring av kalva samanborið við *artemia*. Vøksturin var betri og fellið lægri í teimum bólkunum, sum fingu phytoplankton í mun til teir bólkar, sum fingu *artemia*.

Hvussu ljósið ávirkar kleking, menning og pigmentering av eygunum á kalvayngli var umrøtt í *F:40*. Royndir vórðu gjørdar í myrkri, við hvítum ljósi og við bláum ljósi. Ein háttur at fáa skipaða kleking var við at geva rognunum hvítt ljós, tá ið tey vóru nær kleking og síðani lata tað verða myrkt aftur. Á tann hátt byrjaði klekingin 90 minuttir aftaná at ljósið varð sløkt, og vórðu øll eggini klakt 30 minuttir seinri.

Ein grein var um náttúrliga gýting hjá kalva í stórum kørum (*F:74*). Rognini vórðu savnað og løgd til klekingar, hetta hilnaðist betur, enn tá kalvin verður strokin.

FISKASJÚKUR

Fiskasjúkur vórðu eisini umrøddar á ICES fundinum, m.a. var ein telduskipan framløgd, við nágreiniligari kunning um 131 fiskasjúkur av týdningi fyri alivinnuna og fiskivinnuna (*F:72*). Telduskipanin var gjørd soleiðis, at ein bert skuldi skriva tey makroskopisku sjúkueyðkennini inn í telduna á serligum arki. So leitaði teldan í øllum tilfarinum um fiskasjúkur í telduskipanini og kom síðani við einum uppskoti um, hvør sjúkan var.

UMHVØRVIÐ OG ALIVINNAN

Hvussu avlúsingarevni *Nuvan* ávirkar skeljadjór og algur í umhvørvinum, var umrøtt í *E:18*. Eitt samband var ávíst millum nøgd av *Nuvan* og minkaðan vøkstur fyri ymisk skeljadjór.

Í fleiri av nevndunum vóru dálkingarspurningar á lofti. Ein spurningur, sum ofta verður viðgjørdur, er dálkingin frá alibrúkum. Á fundinum varð løgd fram frágreiðingin frá einum arbeiðsbólki: *Report of the Working Group on Environmental Impacts of Mariculture, F:12.* Umframt at geva yvirlit yvir, hvat verður gjørt í ymsum londum, varð serliga nortið við árin frá heilivágsnýtslu innan alivinnuna á umhvørvið, eisini er heilivágsnýtslan og lúsaviðgerðarevnisnýtslan í ymiskum londum fráboðað. Ein norsk grein, *F:34*, lýsti kanningar av, hvussu djóralívið undir ringunum og gass frá botninum verða ávirkað, alt eftir, hvussu tjúkt skarnlagið undir ringunum er.

YMISKT INNAN HAVBÚNAÐ

Á einum tílíkum fundi sum ICES ársfundinum eru eisini nógvir fyrilestrar um aling fiskasløgum, ið eru okkum fremmand. Nógv tilfar var um aling av hvasskvoysu. Fyri at fáa hana at vaksa, skal hitin í sjónum vera í minsta lagi 14 stig, tí er hetta ikki so áhugavert at fara undir hjá okkum í Føroyum. Fiskasløgini toskur og steinbítur, sum vit í løtuni hvørki arbeiða við á royndarstigi ella ala, men sum høvdu borið til hjá okkum at alt, vórðu eisini umrødd.

Ein grein *F:47* var um byrjunarfóðring av toski. Ymiskt fóður var nýtt, m.a. bleytfóður og ymisk sløg av turrfóðri. Vøksturin var at kalla tann sami í øllum bólkunum, og orsøkin til tað, var mett at verða kannibalisma. Fellið var ymiskt í teimum ymisku bólkunum, frá 39% til 90%, bólkurin, ið fekk bleytfóður hevði lægsta fellið. Í øllum bólkunum var mett, at kannibalisma var orsøk til umleið 50% av fellinum.

Vøkstur av steinbíti og lira var evnið í greinini *F:2*. Í einum 2-ára tíðarskeiðið veksur steinbítur 3 kg, og liri 6 kg. Steinbíturin gerst vanliga kynsbúgvin, tá hann vigar 0,5-1,0 kg, og lirin gerst kynsbúgvin tá hann vigar meir enn 4 kg. Steinbítur og liri eru lívfrøðiliga áhugaverd fiskasløg, at fara undir at ala.

SKELJADJÓR

Í arbeiðsbólkinum fyri skeljadjór vóru hummari, rækja, jákupsskel og oystra kannað, og evnini vóru stovnsmeting, larvuframleiðsla, djóradeyði og føðsluvirði.

Írar lýstu broytingar í longdarbýtinum í djúpvatnshummarastovnunum (*Nephrops norvegicus*) í írska havinum og á Porcupine bankanum (*K:21,K:22*). Onnur greinin vísir m.a. á, at økið, har djúpvatnhummarin veksur skjótt, eisini hevur minni stovnstættleika.

Føroyingar høvdu kannað gýtingargongdina hjá djúpvatnshummara (*K:3*). Her var niðurstøðan, at hummari bert gýtir annað hvørt ár, og kann hetta hava týdning fyri tilgongdina til stovnin og hvussu nógva roynd, hann tolir.

Í Noreg høvdu fiskifrøðingar arbeitt við útseting av yngli hjá tí vanliga hummaranum (*Homarus gammarus*) (*K:2*). Yvir 23.000 yngul vórðu merkt við smámerkjum (enskt: microtags) og undirvatnsmyndir vóru tiknar á sjónbandi, meðan ynglið varð slept fyri at kanna

atferðina í náttúruni mótvegis ránsfiski. Tað sýntist, sum ynglið fann sær skjól innan fyri ein tíma eftir útsleppingina, og eingin ránsfiskur sást. Vøkstur og hvussu nógv doyr av vanligum hummara (*Homarus gammarus*) var evni í grein *K:13*.

Russar mettu um tríggjar rækjustovnar í Barentshavinum og við Svalbard, ið vóru kannaðir í 1989 (*K:4*). Føðsluvirði í rækjum varð kannað av norðmonnum og skotum (*K:10*). Av tí at rækja er føðigrundarlag fyri nógvan gagnfisk, ikki minst toskin, er vitan um hetta umráðandi fyri fólk, ið arbeiða við fleirstovnametingum.

Norðmenn høvdu roynt at ala ungar skeljar av stórari jákupsskel (*Pecten maximus*) í einum náttúrligum hyli við sjógvi (*K:23*). Vøksturin varð kannaður og samanborin við vøksturin á opnum havi. Vøksturin var ymiskur og hevði samband við hitan og nøgdina av plantuæti í umhvørvinum.

Á *The Wash* út fyri eysturstrond Onglands, ein 600 km^2 stórur skeljabanki, ið fjarar turrur ein part av degnum, høvdu onglendingar kannað útbreiðsluna av kræklingastovninum við fotomyndum úr einum flogfari (*K:14*). Hesin arbeiðsháttur spardi nógva tíð, og útrokningar av stovnsstøddini samsvaraðu við veiðuna í økinum.

Á einum skeljabanka út fyri vesturstrond Fraklands, ið var turrur partar av sammdøgurinum, vístu fraklendingar á, at 50-90% av oystruni (*Crassostrea gigas*) doyðu á vári 1988 (*K:11*). Hetta var ein missur uppá 7800 tons. Kanningin vísti, at hetta ikki komst av sjúkuelvandi bakterium ella snúltarum, og dálkandi evni vóru antin ikki tilstaðar ella í nøgdum, ið vóru langt undir vandamarkinum. Avfallið hevði verið umleið tað tvífalda av tí vanliga, saltnøgdin lægri enn vanligt og nøgdin av plantuæti lítil. Hetta, saman við at skeljarnar lógu høgt í fjøruni, hevði við sær, at likamsliga støðan hjá teimum versnaði í so stóran mun, at hetta gjørdist kritiskt.

Gongdin í oystru-fiskiskapinum í einum fjørði á eysturstrondini í USA síðani 1840 var kannað (*K:20*). Fram til 1890 varð stovnurin ovfiskaður, síðani fram til 1980 minkaði úrtøkan vegna minkandi tilgongd av skeljalarvum orsakað av nógvari botnfelling (tilfar frá áum) og ilttroti. Stórt fall í framleiðsluni síðani 1981 komst av, at nógv oystra er deyð av sjúku, etin av øðrum djórum og vánaligari umsiting av skeljastovninum.

HAGFRØÐI

Innan hetta evni verður størstur dentur lagdur á at vísa á roknihættir, ið kunnu nýtast í stovnsmetingum, útrokning av støddini av variatión og feilum í takan av sýnislutum, lýsa eitt hvørt lívfrøðiligt fyribrygdi, t.d. vøkstur hjá tí einstaka fiskinum, matematisk amboð til bólking av mátingarvirði o.s.fr.

Í Fraklandi og Kanada hava menn leingi tosað um at nýta hin sonevnda geostatistiska roknihættin í fiskifrøðiligum kanningum, og frágreiðing frá einum arbeiðsbólki viðvíkjandi hesum varð framløgd (*D:34*). Hesin roknihátturin ger tað m.a. møguligt at rokna stovnstættleikan í hvørjum punkti í kanningarøkinum, og eisini hvussu stór variatiónin er í hvørjum punkti. Á tann hátt ber til at velja, hvar á kortinum næsta kanningarstøð skal verða fyri at minka mest møguligt um variatiónina. Vanligi statistiski roknihátturin krevur, at kanningarstøðirnar eru tilvildarligar spjaddar í kanningarøkinum, men hin geostatistiski hátturin leggur upp til, at kanningin verður gjørd við regluligum millumbilum, sum t.d. við ekkóloddkanningum. Hetta ger eisini kanningararbeiðið bíligari. Ein fraklendingur greiddi frá grundarlagnum undir hesum roknihættinum (*D:12*), og greinin *D:25* vísti á, hvussu geostatistikk kann nýtast í ekkóloddkanningum.

Ein russi hevði eina grein um møguleikan fyri at gera eitt matematiskt model av samspælinum millum leiðina hjá havstreymunum og treytirnar fyri m.a. ferðingarlagnum hjá svartkjafti (*D:7*).

Í Kanada hava menn funnið týðiligt samband millum árliga vøkstrinum hjá toski og broytingar i sjóvarhitanum og vektina av toskastovninum (*D:21*). Hin vegin er veikari samband millum árliga vøkstrinum hjá toski og lutfallið millum tal av lodnu og stovnsvekt hjá toski.

Greinin *D:16* viðgjørdi eina broyting i vanligu vakstrarlíkningini (hjá von Bertalanffy), so tað er gjørligt at lýsa vøkstur hjá fiski, ið livir av ymiskari føði í tveimum tíðarskeiðum í lívi sínum, t.d. ein fiskur, sum í fyrsta parti av lívinum etur djóraæti, og seinri fyri tað mesta etur fisk.

SAMANDRÁTTIR AV GREINUM VIÐGJØRDAR Í HESUM RITI

Bólkur B, Fish Capture Committee, ið viðger fiskihættir og ekkóloddkanningar.

C.M.1990/B:2 - Theme Session R

Toresen, R. (Institute of Marine Research, P.O. Box 1870 Nordnes, N-5024 Bergen, Norway)

ABSORPTION OF ACOUSTIC ENERGY IN DENSE HERRING SCHOOLS STUDIED BY THE ATTENUATION IN THE BOTTOM ECHO SIGNAL

The absorption of acoustic energy in herring schools is studied by echo integration of the bottom signal under various densities of herring. The investigations were carried out in a fjord in northern Norway, where large schools of adult herring overwinter. The intensity of the bottom signal, expressed by the integrator value (reflected area in square meters per square nautical mile (m^2/NM^2)) of the bottom decreased significantly as the density of herring increased. The bottom integrator value decreased exponentially from 1.39 to 0.36 · 10^5 as the area density of herring increased from 0 to 550 · 10^3, corresponding to an increase in number of herring per square meter of 0 - 180. A method for correction of this effect is also presented.

C.M.1990/B:3 - Theme Session O

Koeller, P.A. (Marine Assessment and Liaison Division, Bedford Institute of Oceanography, P.O. Box 1006, Dartmouth, N.S. B2Y 4A2, Canada)

CONTROLLING THE VARIABILITY OF SURVEY GEAR PERFORMANCE

Biologists responsible for groundfish abundance surveys are becoming more aware of the value of real-time information on survey gear behaviour as they collect and analyze information previously available only to gear technologists working under controlled conditions. Once the survey performance parameters of individual trawls are known the next step should be to control the variability of parameters which can be controlled, rather than to standardize the catch using catch/parameter relationships which are themselves highly variable or subject to dubious assumptions. Data from Scotian Shelf surveys are presented describing biases in abundance indices caused by variations in one parameter, door spread. It is possible to interactively change warp length to achieve constant door spread throughout most of a survey. The possible consequences of such a methodological change to the continuity of the survey time series are discussed. While biases due to the spread/depth relationship can be significant its contribution to the overall variance of stratified random survey abundance estimates is negligible.

C.M.1990/B:28 - Theme Session U

Suuronen, P. (Finnish Game and Fisheries Research Institute, Fisheries Division, P.O. Box 202, SF-00151 Helsinki, Finland)

PRELIMINARY TRIALS WITH A SQUARE MESH CODEND IN PELAGIC HERRING TRAWLS

Comparative fishing trials with a twin codend trawl were used to compare the size selectivity of a square mesh codend with that of a diamond mesh codend of the same nominal mesh size (36 mm). Altogether, 34 hauls were made in the northern Baltic (ICES Sub-division 29N) in May-June 1990. The catches in the two sides of the trawl varied considerably, suggesting a systematic difference in catchability between the sides. Underwater TV observations confirmed that the separator section of the trawl did not operate properly. Due to the technical difficulties, the results must be regarded as preliminary, but they suggest that a square mesh codend will have a sharper selectivity and will retain fewer juvenile herring than an equivalent size diamond mesh codend. The problems of fitting a separator section to an existing commercial trawl are discussed.

C.M.1990/B:31 - Theme Session R

Ona, E.[1] and Traynor, J.[2] ([1]Institute of Marine Research, P.O. Box 1870 Nordnes, N-5024 Bergen, Norway, [2]Alaska Fisheries Science Center, 7600 Sand Point Way, Seattle, WA 98115, USA)

HULL MOUNTED, PROTRUDING TRANSDUCER FOR IMPROVING BAD WEATHER ECHO INTEGRATION;

A 38 kHz split beam survey transducer has been mounted on the tip of a 4 m vertical protrusile stabilizing keel of the United States NOAA fishery research vessel R/V "Miller Freeman". Air blocking problems, generally observable on all hull mounted transducers, were reduced to a minimum, and excellent acoustic conditions were achieved with the new mounting up to wind speeds of 35 knots (19 m/s). The improvements are demonstrated through comparative, sequential echo integration of the air close to the transducer with the keel alternating between upper (retracted) and lower (extended) positions, and through echo recordings on fish. Reasonable functions for residual air bubble corrections of echo integration data will presumably work well up to wind speeds where target identification by trawl is problematic because of safety.

SWIMMING BEHAVIOUR OF FISH SCHOOLS IN THE NORTH SEA DURING ACOUSTIC SURVEYING AND PELAGIC SAMPLING TRAWLING

by

/ B:38

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ABSTRACT

Swimming behaviour of schooling herring, mackerel and sprat, when approached by a survey vessel, was observed by aid of a true motion sonar. Observations were made both during surveying and during pelagic trawling. Horizontal swimming speed was clearly length dependent, but there were great variations from one school to another, even if the school members were of similar size. Generally the schools seemed to be guided by the approaching vessel, but often the schools avoided the path of the vessel. An attempt is made to quantify the influence of vessel-avoidance and upper blind zone distribution on the total abundance estimate. By taking advantage of the guiding effect, and modifying the gear rigging, the capture success of the pelagic sampling trawl was clearly increased.

C.M.1990/B:39
Løkkeborg, S. (Institute of Fishery Technology Research, Fishing Gear and Methods Division, P.O. Box 1964, N-5024 Bergen, Norway)
FISH SHAPED BAIT DOES NOT IMPROVE THE RESPONSE OF COASTAL COD

The behaviour of coastal cod (Gadus morhua) towards baits of two shapes, one rectangular and one shaped to represent a fish, was observed in the sea with underwater television. Cod showed no difference in the response towards the two bait types. This is explained by a great breadth of diet of coastal cod, and other bait characteristics than shape being more important for bait selection. Large cod showed a more intense response towards the baits than small cod.

C.M.1990/B:46 - Theme Session U
Isaksen, B. and Valdemarsen, J.W. (Institute of Fishery Technology Research, P.O. Box 1964, N-5024 Bergen, Norway)
CODEND WITH SHORT LASTRIGDE ROPES TO IMPROVE SIZE SELECTIVITY IN FISH TRAWLS

In recent years much effort has been conducted to improve the size selectivity in codends. Most of this effort has been concentrated on square mesh codends. In Norway this work has also included testing other mesh configurations. This report presents the results from testing of codends with two 12-15% shorter lastrigde ropes.

The roped codend maintained its selectivity properties better as the codend fills up with fish, and is thus less sensitive to the amount of catch than a conventional codend design. A codend of 135 mm meshes with lastrigde ropes has a selectivity comparable to a 150 mm convention codend.

C.M.1990/B:47 - Theme Session U
Isaksen, B.[1], Valdemarsen, J.W.[1] and Larsen, R.B.[2] ([1] Institute of Fishery Technology Research, P.O. Box 1964, N-5024 Bergen, Norway, [2] Norwegian College of Fisheries Science, P.O. Box 3083, Guleng, N-9001 Tromsø, Norway)
REDUCTION OF FISH BY-CATCH IN SHRIMP TRAWL USING A SOLID SEPARATOR GRID IN THE AFT BELLY

During 1989-1990, a new concept to avoid by-catch of fish in shrimp trawl has been developed in Norway. The system consists of an aluminium grid, 0.6 - 1.0 m wide and 1.3 - 1.5 m long, with bars spaced 19 mm. The grid is installed in the extention piece in front of the codend, angled 45°, and with a fish outlet on the top. In front of the grid is mounted a guiding funnel or flapper.

Several practical tests with commercial trawlers are conducted. Performance of the system and behaviour of fish and shrimp relative to it has been studied with a remote controlled underwater TV-vehicle.

Escapement of fish like cod, haddock, redfish and Greenland halibut is better than with any by-catch device tested earlier. Handling cause no significant problems, neither on small nor larger shrimp trawlers. Loss of shrimp when using the system is acceptable, less than 5%.

An extensive effort is taking place to introduce this selective device in all Norwegian shrimp fisheries. From March 1, 1990 the separator grid was introduced by law in the northern coastal shrimp fishery.

C.M.1990/B:51 - Theme Session U
Isaksen, B.[1], Lisovsky, S.[2] and Sakhno, V.A.[2] ([1] Institute of Fishery Technology Research, Fishing Gear and Methods Division, P.O. Box 1964, N-5024 Bergen, Norway, [2] Polar Research Institute of Marine Fisheries and Oceanography (PINRO), 6 Knipovich Street, Murmansk, USSR)
A COMPARISON OF THE SELECTIVITY IN CODENDS USED BY THE SOVIET AND NORWEGIAN TRAWLER FLEET IN THE BARENTS SEA

In August/September 1989, joint Soviet-Norwegian selectivity experiments were performed east of Rybackya Bank (Østbanken) in the Barents Sea. The main aim of the experiments was to compare the selectivity in codends used by the Soviet and Norwegian trawler fleet. Of the two methods used to establish the selectivity parameters, bag type cover and trouser trawl, the last method was used to compare the results, indicating slightly better selectivity properties of the Soviet codend, roughly a 0.2 higher selection factor, and a selection range that was 3-4 cm narrower than for the Norwegian codend. This difference is explained by the different kind of codend material used by the Soviet and Norwegian trawler fleet.

Bólkur C, Hydrography Committee, ið viðger havrannsóknir.

C.M.1990/C:7 - Ref.: Marine Environmental Quality Committee
Weichart, G. (Deutsches Hydrographisches Institut, Postfach 220, 2000 Hamburg 4, Federal Republic of Germany)
THE QUALITY OF "OLD" OCEANOGRAPHIC PHOSPHATE DATA

Temporal trends of substances in the environment can only be proved if the old and the new data are reliable. For the quantitative analysis of inorganic phosphate in sea water the historical development during the past hundred years is reviewed briefly. A critical examination of the different methods shows that phosphate data can be considered reliable from 1923 onwards, if a number of analytical conditions were fulfilled.

C.M.1990/C:36 - Ref.: Demersal Fish, Pelagic Fish, and Biological Oceanography Committees
Murawski, S.A. and Mountain, D.G. (National Marine Fisheries Service, Northeast Fisheries Center, Woods Hole, Massachusetts 02543, USA)
CLIMATE CHANGE AND MARINE FISH DISTRIBUTIONS: ANALOGIES FROM SEASONAL AND ANNUAL VARIABILITY

A scenario of long-term atmospheric warming has potentially profound consequences for coastal hydrography, and thus for the organisms occupying these areas. No more so than for the North Atlantic region, which in some modelling studies, is predicted to warm differentially greater than the world as a whole. A range of biological responses of organisms can be expected from such a scenario, including changes in distribution, recruitment, growth, and other temperature-dependent processes. In this study, we consider some potential impacts of oceanic warming as they may influence marine fish distributions from bottom trawl surveys conducted over a 21 year period. Our approach is to develop several metrics of the average position and dispersion of fish stocks ('center of gravity' and 'size of the footprint') and to correlate the observed patterns of these attributes to inter-annual and inter-seasonal trends in average surface and bottom water temperatures, as well as other attributes such as stock density. Analyses are conducted for 36 marine fish and squid species occurring in continental shelf waters off the northeast USA.

The 36 species examined exhibit a continuum of sensitivity to temperature variability, as evidenced by the apparent 'preferences' for specific temperature or depth regimes. Average shelf bottom water temperatures may vary by as much as 20 degrees, seasonally. Some species (e.g. flatfishes), exhibit little apparent seasonal depth change, and are thus subject to extreme variability in temperatures of occurrence. Others, such as squid and other pelagics, exhibit considerably less variability in temperatures of occurrence, but vary widely in depths. Thus, it is possible to classify potential sensitivity of distribution to temperature shift, on the basis of this continuum.

The period 1968-1989 exhibited several years of anomalously low and high temperature conditions on the northeast shelf. Average position and spread of the 36 stocks are evaluated in relation to shelf temperatures and stock densities. Results emphasize the utility of using historical patterns of distribution in relation to historical temperature conditions. Temperature regimes exhibited in the 21 year time series certainly are more extreme than average shelf warming predicted for the next several decades by most models.

C.M.1990/C:37 - Theme Session P
Cornillon, P. (Graduate School of Oceanography, University of Rhode Island, Narragansett, Rhode Island 02882, USA)
SATELLITE-DERIVED GLOBAL SEA SURFACE TEMPERATURE FIELDS: 1981-PRESENT

A group of oceanographers from academia and from U.S. Federal laboratories, assembled under the auspices of NASA (National Aeronautics and Space Administration), have outlined a global SST (Sea Surface Temperature) product for use in feature-related oceanographic studies. The SST fields associated with this product will be produced from the global GAC (Global Area Coverage) AVHRR/2(5-channel Advanced Very High Resolution Radiometer) data set and will cover the period from June 1981 to present. The project as now figured is being viewed by NASA and NOAA (National Oceanographic and Atmospheric Administration) as an EOS (Earth Observing System) version 0 prototype activity; i.e., a data management demonstration project.

The path to be taken in the production of the SST fields will follow closely that taken for the recently completed Global Chlorophyll Project for which all available CZCS data were processed. The major difference between the SST effort and the Global Chlorophyll Project, is that substantially more data will be handled in the former, and the SST data set is not closed/complete; production of the fields will continue indefinitely into the future, hence the system designed must be capable of handling a continuous data stream in near-realtime.

This presentation will review the considerations that went into designing the SST fields, will discuss potential applications of the fields and will outline the progress to date in their production.

C.M.1990/C:41 - Theme Session P
Barale, V.[1], Fusco, L.[2], and Schlittenhardt, P.[1] ([1]IRSA, CEC-JRC, 21020 Ispra (VA), Italy, [2]EPO, ESA-ESRIN, 00044 Frascati, Rome, Italy)
THE OCEAN COLOUR EUROPEAN ARCHIVE NETWORK (OCEAN) PROJECT

The CZCS experiment (1978-1986) has provided a great wealth of information on various oceanographic topics, ranging from bio-geo-chemical parameters in surface waters to dynamical processes of the sea. The OCEAN Project, an initiative of CEC-JRC and ESA, will perform a thorough reappraisal of all CZCS data covering marine regions of European concern. The objectives of the Project include the pre-processing of all data available; the generation of a reliable, well documented, easily accessible archive; the processing of all suitable data, using ad hoc algorithms purposely assembled for OCEAN, to the final geophysical parameters of interest; the preparation of time series, mosaics and statistical images, that will be provided to several application demonstration programmes to be carried out in Europe. Finally, an Announcement of Opportunity is planned to maximize the diffusion of CZCS value-added data throughout the user community, in support of current research activities and in preparation for future ocean colour missions.

Bólkur D, Statistics Committee, ið viðger roknihættir innan fiskifrøði.

C.M.1990/D:12
Petitgas, P. (Centre de Géostatistique, Ecole Nationale supérieure des Mines de Paris, 35 rue St-Honoré, 77305 Fontainebleu, France)

A GEOSTATISTICAL VARIANCE OF THE TOTAL ABUNDANCE ESTIMATE FOR A REGULAR SAMPLING GRID

Systematic sampling designs are very convenient for prospecting large sea areas and are frequently used. In acoustic surveys, for instance, the data are collected continuously along transects which are regularly spaced. In the case of regular grid sampling designs, Matheron (1965, 1971), gives an approximation principle of the exact expression of the variance of estimation, for practical computations. This principle is based on the theory of approximation of integrals as the exact expression of the variance is a difference between an integral of the variogram and discrete approximations of it. The range of the spatial correlations and the distance between grid nodes of the sampling design play a special role.

As an example, we used an acoustic survey of herring off the Norwegian coast. The survey is performed along regularly spaced transects. The abundance is estimated by spatial integration, thus a rectangle of influence is assigned to each transect. The regionalisation of the fish is interpreted as a realisation of an intrinsic random funtion independent of the spatial limits of fish presence. A geostatistical variance of the estimation of the mean is calculated within this model using the approximation principle and leads to a coefficient of variation of 13% on the raw data. The problems encountered in computing a relevant variogram are related to the skewness of the histogram and to the many bordering zero values. These delimit the geometry of fish presence. The importance of the geometry in the computation of the variance is stressed.

This two-dimensional procedure for computing the variance of estimation is then compared to a one-dimensional procedure in which the values are cumulated along the transects. The reasons why this second method leads to a less precise estimation are investigated.

C.M.1990/D:16
Soriano, M.[1], Moreau, J.[2], Moenig, J.M.[3], and Pauly, D.[1] ([1]International Center for Living Aquatic Resources Management, MC P.O. Box 1501, Makati, Metro Manila, Philippines, [2]Department of Inland Fisheries, Faculty of Agronomy, 145 Avenue de Muret, 31076 Toulouse, Cédex, France, [3]Science Branch Department of Fisheries and Oceans, P.O. Box 5667, St. John's, Newfoundland A1C 5X1, Canada)

NEW FUNCTIONS FOR THE ANALYSIS OF TWO-PHASE GROWTH OF JUVENILE AND ADULT FISHES, WITH APPLICATION TO NILE PERCH

Two phases of growth can sometimes be distinguished in long-lived fish species. The first phase involves zooplankton-feeding juveniles and young adults. The second phase consists of accelerated growth of large, piscivorous adults. We present two modified versions of the von Bertalanffy growth equation which account for this feature and fit them to length-at-age data on Nile perch Lates niloticus (Centropomidae). The growth parameters estimated for the new equations allow one to make preliminary estimates of the energy gains in Nile perch associated with transition from zooplanktivory to piscivory.

Uncertainty associated with cod-capelin interactions: How much is too much?

D:21

Peter A. Shelton, Lenore Fahrig and Russell B. Millar

Abstract

Previous analyses have shown that cod annual length increments off Newfoundland and Labrador are positively related to temperature anomaly and to 1/(cod biomass). It has also been shown that replacing 1/(cod biomass) with (capelin abundance index)/(cod biomass) results in a much weaker fit. A randomization test supported the conclusion that there was insufficient evidence to reject the null hypothesis that cod length increments are independent of capelin abundance. In this paper the probability of type II error (not rejecting the null hypothesis when it should have been) in the earlier analyses is examined by simulating fake length increment data from a growth model with error and carrying out similar fits to those attempted on the real data. It is argued that the cost of type II error could be large if it precipitates an increase in commercial exploitation of capelin.

C.M.1990/D:25 - Ref.: Fish Capture and Pelagic Fish Committees
Foote, K.G. and Stefánson, G. ([1]Institute of Marine Research, P.O. Box 1870 Nordnes, N-5024 Bergen, Norway)

DEFINITION OF THE PROBLEM OF ESTIMATING FISH ABUNDANCE OVER AN AREA FROM ACOUSTIC LINE-TRANSECT MEASUREMENTS OF DENSITY

The problem of acoustic abundance estimation is briefly reviewed. Under proper conditions, fish density can be measured with high accuracy along line transects. Observed variations in fish density consequently reflect biological variations, or inhomogeneity in spatial distribution. The particular problem of estimating fish abundance over an area from line-transect measurements of fish density is defined. Related problems of estimating the variance of the abundance estimate and of mapping the spatial distribution are also defined. A partial list of candidate methods for solving the several problems is given. Among these, the so-called spatial statistical techniques appear to be most promising because of their exploitation of the observed spatial structure.

Bólkur E, Marine Environmental Quality Committee, ið viðger havumhvørvi og dálking.

C.M.1990/E:4 - Ref.: Demersal Fish and Baltic Fish Committees

Bagge, O., Nielsen, E., Mellergaard, S., and Dalsgaard, I. (Danish Institute for Fisheries and Marine Research, Charlottenlund Castle, DK-2920 Charlottenlund, Denmark)

HYPOXIA AND THE DEMERSAL FISH STOCKS IN THE KATTEGAT (IIIA) AND SUB-DIVISION 22

The development of the demersal commercial fish stocks in the Kattegat (IIIa) and Sub-division 22 in the period 1970-1989 has been dealt with.

The decreasing recruitment the last 10 years of cod and plaice and the increasing recruitment of dab is discussed and related to hypoxia and eutrophication. The growth of plaice and dab and the frequencies of viral diseases in dab are discussed in the same context.

The changing catchability of Norway lobster due to hypoxia, the increasing effort and decreasing catch per unit of effort indicate a decreasing stock.

C.M.1990/E:6

Mellergaard, S. and Nielsen, E. (Danish Institute for Fisheries and Marine Research, Charlottenlund Castle, DK-2920 Charlottenlund, Denmark)

FISH DISEASE INVESTIGATIONS IN DANISH COASTAL WATERS WITH SPECIAL REFERENCE TO THE IMPACT OF OXYGEN DEFICIENCY

Long-term (1983-1990) recordings of data on the prevalence of the externally visible fish diseases, lymphocystis, epidermal papillomas and skin ulcers in common dab (Limanda limanda L.) populations in the German Bight, the eastern North Sea, the Skagerrak and the Kattegat are presented.

The trends in the development of these diseases and the eventual background for the development are discussed. The data indicate that most skin ulcers probably develop from mechanical lesions caused by fishing gear.

The occurrence of oxygen deficiency seems to trigger the spread and development of fish diseases such as lymphocystis and epidermal papillomas. The risk of getting a disease is significantly higher for fish in regions that have suffered from oxygen deficiency. However, an adaptation to recurring oxygen deficiency seems to take place.

C.M.1990/E:11

Vethaak, D.[1] and Rheinallt, T. ap[2] ([1]Ministry of Transport and Public Works, Public Works Department, Tidal Waters Division, Ecotoxicology Section, P.O. Box 20907, 2500 EX The Hague, Netherlands, [2]WRc Medmenham, Henley Road, Medmenham, P.O. Box 16, Marlow, Bucks SL7 2HD, United Kingdom)

A REVIEW AND EVALUATION OF THE USE OF FISH DISEASES IN THE MONITORING OF MARINE POLLUTION IN THE NORTH SEA

The use of fish diseases to monitor marine pollution in the North Sea is reviewed and evaluated. Criteria for epidemiological surveys are outlined, a brief history of fish disease in relation to pollution given, and recent studies in the North Sea described and evaluated. Information on the possible pollution-related actiology of some conditions is reviewed.

The basic approach is to identify spatial and temporal patterns of disease prevalence, which can be related to pollution. A major obstacle is to distinguish effects of pollution from those of other variables, especially as most diseases appear to have a multifactorial actiology. Other problems include difficulties of access and operation, high cost, and the need to use prevalence as an estimate of incidence.

Special criteria for establishing cause-effect relationships have already been developed. Specific criteria for field surveys include accuracy and precision of prevalence estimates, the extent to which possible causal factors other than pollution are taken into account, and whether or not exposure of the study population to pollution is measured directly.

Several convincing examples of a relationship between pollution and disease have been identified in the North Sea over the past decade: most apply to local areas with distinct sources of pollution. The data from wider-ranging surveys are more controversial: while some provide circumstantial evidence for a role of pollution, the apparent complexity of disease actiology (in itself a significant finding) and the limitations of the epidemiological approach may effectively prevent any unambiguous demonstration of pollution as a cause.

Due largely to methodological shortcomings, it is not yet possible to assess whether or not there has been a long-term increase in disease prevalence associated with a general increase in pollution in the North Sea. For the future, the use of standardised methods is very important. It is recommended that future work should place greater emphasis on the recording of liver lesions, on the measurement of contaminant concentrations, and on experimental work.

THE TOXICITY OF DICHLORVOS TO SOME MARINE ORGANISMS E:18

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ABSTRACT

This paper presents information on the acute and chronic toxicity to marine organisms of dichlorvos, an organophosphorus pesticide used to control lice on farmed salmon. The acute toxicity of dichlorvos (tested as Nuvan 500 EC) to crustacean larvae Crangon crangon and Mysidopsis bahia was 4.4 and 11.1 ug l^{-1} respectively (96h LC50). Molluscs were less sensitive (adult Patella vulgata 96h EC50 = 14.4 ug l^{-1}, based on foot relaxation; larval Crassostrea gigas 48h EC50 = 165 ug l^{-1}, based on abnormal development) and marine algae were relatively insensitive (of three species tested, the most sensitive was Isochrysis galbana, whose growth over 20 days was normal at 100 ug l^{-1}, but inhibited at 1000 ug l^{-1}). Chronic growth tests were conducted with juvenile bivalve molluscs, C. gigas, Venerupis decussata and Mytilus edulis. The growth of the most sensitive species, C. gigas, was significantly reduced over 49 days at nominal concentrations of 33 ug l^{-1}.

C.M.1990/E:22
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BIOAVAILABILITY OF TRACE METALS IN MARINE SEDIMENTS

As part of an interdisciplinary research programme, benthic organisms and sediments obtained from two different areas of the southern North Sea have been analyzed for selected heavy metals. Lead and cadmium contents were measured in the polychaete species Nephtys hombergi and in the sea-urchin Echinocardium cordatum as well as in respective sediment fractions < 20 µm from the entire Dogger Bank and the eastern coastal North Sea. The cadmium concentrations determined in all species from these areas were relatively equal, except for a slight increase in concentration found in those species from the northeastern part of the Dogger Bank. No correlation was found to cadmium contents in sediments. A lower lead content was generally observed in the individuals taken from the German Bight than those from the Dogger Bank, especially from again its northeastern part. In case of lead, it is possible to divide both areas according to the slope found in the linear regression of lead versus total organic carbon contents in sediments (i.e., according to the gradient method of metal concentration normalization introduced by CATO, 1977), which is twice as steep for the Dogger Bank as for the eastern North Sea. This criterium points to a difference in sediment quality with regard to toxic metal contamination. The sediment quality of the Dogger Bank seems to be twice as bad in comparison with that of the eastern North Sea, which is in turn in good agreement with the differences found in lead contamination of the sediment-dwelling polychaetes from both areas. The low correlations found between metal contents in the organisms and sediments indicate an uptake mechanism which is probably controlled by the dissolved metal activity rather than the particulate metal concentrations. The metal activity in interstitial water is controlled by the redox geochemistry at the sediment-water interface, which in turn is controlled to a considerable degree by the organisms themselves. Experimental results with toxic metal release rates gained from sediments incubated at different oxygen saturation levels elucidate the effect of bioturbation and ventilation of anoxic sediment strata with overlying oxic water, which significantly enhances flux of readily bioavailable dissolved metals.

Bólkur F, Mariculture Committee, ið viðger havbúnað.

C.M.1990/F:2 Ref.: Demersal Fish Committee
Moksness, E.[1] and Stefansson, D.[2] ([1]Institute of Marine Research, Ministry of Fisheries, Flødevigen Marine Research Station, N-4817 His, Norway, [2]Biological Institute, Department of Marine Zoology, University of Oslo, P.O. Box 1064, Blindern, N-0316 Oslo 3, Norway)
GROWTH RATES IN CULTURED COMMON WOLFFISH (ANARRICHAS LUPUS) AND SPOTTED WOLFFISH (A. MINOR)

Field caught common wolffish (Anarhichas lupus) and spotted wolffish (A. minor) have been raised from fry on dry pellets. The two species have experienced annual fluctuations in temperature between 6° and 12°C and the results indicates that both species have their best growth rates below 10°C. With initial average wet weights of 2.6 g (common wolffish) and 6.3 g (spotted wolffish), and at equal experimental conditions, the spotted wolffish reached four times the wet weight of the common wolffish over a period of two years and 10 months, 3.4 and 0.9 kg respectively. The specific growth rate, however, were 0.62% d^{-1} and 0.58% d^{-1} respectively, indicating only small differences in growth rates in that period. Estimates based upon the fastest growing fish in the experimental groups indicated that at optimum temperature conditions (approx. 6°C) the spotted wolffish will probably reach a total wet weight of 6 kg in two years from start-feeding, while the common wolffish (below 10°C) will reach a weight of 3 kg in that same period. The common wolffish mature at a size from 0.5 - 1.0 kg, while the spotted wolffish mature at a size above 4 kg.

C.M.1990/F:7
Juell, J.-E. (Institute of Fishery Technology Research, P.O. Box 1964, N-5024 Bergen, Norway)
HYDROACOUSTIC DETECTION OF FOOD WASTE - A METHOD TO ESTIMATE MAXIMUM FOOD INTAKE OF FISH POPULATIONS IN SEA CAGES

A linear relationship between echo energy and amount of salmon dry food was established. Measurements were carried out both for food batches (5-400 gram) and single pellets. For a certain amount of food, the echo energy decreased when pellet size increased. The relationships allowed hydroacoustic detection of small amounts of food waste. Maximum food intake of a salmon population was determined as the amount of food delivered by the feeder before food waste was detected.

C.M.1990/F:8 - Theme Session O
Silvert, W.L., Keizer, P.D., Gordon Jr., D.C., and Duplisea, D. (Habitat Ecology Division, Department of Fisheries and Oceans, Bedford Institute of Oceanography, P.O. Box 1006, Dartmouth, NS B2Y 4A2 Canada)
MODELLING THE FEEDING, GROWTH AND METABOLISM OF CULTURED SALMONIDS

The rapid growth of aquaculture has raised concerns about potential environmental impacts on coastal habitat and negative feedbacks to the industry itself. The prediction of impacts is different because of the wide variety of physical, chemical and biological processes which affect the consumption of oxygen and release of wastes by cultured organisms. Using the interactive workshop technique and the BSIM modelling package, we have developed a model which simulates the critical ecological processes that take place within, around and beneath a sea cage filled with salmon. This model, called SITE, is being developed in parallel to a field program and tested in the L'Etang Inlet of New Brunswick (Canada), an area of expanding salmon farming. In general, the behaviour of the model is consistent with available field data and it is steadily improving as new results are incorporated. In conjunction with a detailed hydrodynamic model, the SITE model will be used to help plan experiments directed at understanding the dynamics of the water and sediment chemistry and biology at an aquaculture site and to explore the capacity of the L'Etang Inlet to assimilate wastes from salmon farms. The SITE model is available to other research teams interested in experimenting with it.

A PROPOSED GLOSSARY ON BIOLOGICAL AND TECHNICAL TERMS RELEVANT TO AQUACULTURE F:21

"FIRST DRAFT"

by

Harald Rosenthal[1], Volker Hilge[2], Hans Ackefors[3], David Bucke[4] James E. Stewart[5], J. D. Castell[5]

ABSTRACT

The application of basic knowledge to aquaculture systems is a complex of scientific, engineering, economic, legal or political processes. Fragmentary inputs from various disciplines, often derived from disharmonious efforts, have frequently resulted in the misuse and misinterpretation of terms and criteria, and consequently, have led to incorrect applications and costly failures. This glossary has been prepared, in response to a request of the Mariculture Committee, as an initial attempt to provide definitions of terms and some interpretation of their common use (ICES, Mariculture Committee, Doc. 1988/F:34). Numerous comments have been received in response to a questionaire attached to the above cited document. During the 76th Statutory Meeting of ICES it was decided to expand this document and join efforts with EIFAC to produce a more general glossary on terms frequently used in aquaculture. Various Working Groups of ICES have also contributed definitions of terms relevant to their specific field. A joint ICES/EIFAC Correspondence Group started its work during 1989, incorporating those comments provided by colleagues from various member states. For a number of terms more than one definition has been formulated, often reflecting the useage in different disciplines. The present draft document should be considered a discussion paper. To aid those interested in helping to improve, extend or otherwise modify this draft glossary, the current mailing address of the Senior Author is provided for ease of intervention. Members of EIFAC are requested to provide comments not later than August 15 to the first author. A final decision on the content and the layout of the glossary will be made at the Statutory Meeting of ICES in October 1990 in close contact with the Chairman of EIFAC Session II; EIFAC will make an attempt to translate the final document into French.

COMPARISONS OF BROODFISH QUALITY AND EGG QUALITY IN ATLANTIC SALMON OF NORWEGIAN FARMED STRAIN, WILD ATLANTIC SALMON AND OCEAN RANCHING ATLANTIC SALMON OF NORWEGIAN FARMED STRAIN

F:33

by

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ABSTRACT

Broodfish of different origin (Atlantic salmon of Norwegian farmed strain, wild Atlantic salmon and ocean ranching Atlantic salmon of Norwegian farmed strain) were kept under similar conditions from august. In november eggs were stripped, and put in the hatchery. Chemical analyses were made of broodfish carcass, liver, blood and of the eggs at the time of stripping and after hatching. Survival of the eggs were registered until startfeeding. The result showed differences in the chemical content of both broodfish and egg, as well as in egg survival between the wild salmon and the farmed strain.

C.M.1990/F:34 - Ref.: Marine Environmental Quality Committee
Hansen, P.K.[1], Pittman, K.[2], and Ervik, A.[1] ([1]Department of Aquaculture, Institute of Marine Research, Postbox 1870 Nordnes,, N- 5024 Nordnes, Bergen, Norway, [2]Department of Fisheries Biology, University of Bergen, Nordnesgaten 33, N-5024 Bergen, Norway)

EFFECTS OF ORGANIC WASTE FROM MARINE FISH FARMS ON THE SEABOTTOM BENEATH THE CAGES

Seven fish farms and a control station were investigated four times during one year. The farms represented a gradient of increasing accumulation of organic waste on the seabottom. The thickness and the organic content of the waste increased up to 20 cm with increasing sedimentation. When the thickness of the accumulated waste exceeded 20 cm the larger fauna (>5 mm) disappeared, and the decomposition rate of the material as a function of the accumulated amount decreased. The release of ammonia and the spontaneous gas ebullition from the waste increased linearly with increasing accumulation.

After an initial increase, phosphate was not released in significantly higher amounts when accumulations exceeded 7 cm. Preliminary analysis of stable carbon isotope ratios of the sediment suggests that there is a return to original background isotope ratios within 30 m of a well-run fish farm.

STUDIES ON ENVIRONMENTAL CONDITIONS AND INFLUENCE ON SALMON FARM PRODUCTION

F:35

Arne Ervik, Knut E. Jørstad, Eva Farestveit, Vidar Wennevik, Anne Grete Eriksen & Rita Leroy

Abstract

The study was undertaken to investigate how environmental conditions influence growth of Atlantic salmon, and how different sib groups of salmon respond to different environment. The fish were raised at five different marine fish farms, and environmental conditions, growth and management were controlled routineously. The fish farms had different environmental conditions with regard to concentration of oxygen of ammonium. There were no simple connection between environment and growth. Farm management seems to be the most important single factor controlling growth. In several cases significant differences in family ranking between the fish farms were detected.

C.M.1990/F:40
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LIGHT AFFECTS HATCHING, DEVELOPMENT AND PIGMENTATION OF HALIBUT (HIPPOGLOSSUS HIPPOGLOSSUS L.)

Artificially fertilized halibut eggs were exposed to various colours of light and their development, hatching and eye pigmentation was monitored. Hatching was delayed relative to development up to 19 days under white light although the enclosed larvae developed apace with the emerged larvae showing that anoxia is not a primary hatching stimulus. Extension of the period in the egg did not affect the normal rate of organogenesis but the belt of hatching gland cells degenerated. Time of hatching could be synchronized by exposing the eggs to light for a period and returning to darkness, where hatching would take place within 90-120 minutes. Eye pigmentation was earliest and darkest under dim (0.2 lx) blue light whereas pigmentation was latest and lightest when larvae were held in darkness, suggesting that dark-rearing interrupts or delays normal eye development. Growth was not significantly different between these two groups. Two areas in the eye, a bar posterodorsal to the lens and spot ventral to the lens, were the last to develop pigment under all treatments. An ecological model is proposed where light is a primary mechanism regulating the larval distribution in the water.

C.M.1990/F:47

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WEANING TRIALS WITH COD FRY ON ARTIFICIAL DIETS

Three experiments with different size groups of cod fry, 13, 49 and 465 mg wet weight were offered 6 different artificial diets. The experiments lasted for 28 days. Growth, and for the medium size-group chemical composition and gross energy-content of the fish were measured. Mortality was recorded daily, and the fish were counted after 14 days and at end of the experiments to correct for cannibalism.

Growth seemed to be similar on all diets, probably because of prominent cannibalism. Significant differences in biomass and survival were found. Survival ranged from 0 to 39% for the smallest group and from 72 to 90% for the largest group. About 50% of the mortality was due to cannibalism.

C.M.1990/F:50

Smail, D.A., Huntly, P.J., and Munro, A.L.S. (DAFS Marine Laboratory, Victoria Road, Aberdeen AB9 8DB, Scotland)

FATE OF FOUR FISH PATHOGENS AFTER EXPOSURE TO AN ENSILING MIXTURE CONTAINING FISH FARM MORTALITIES

Exposing three bacterial fish pathogens (*Aeromonas salmonicida*, *Yersinia ruckeri*, and *Renibacterium salmoninarum*) to a commercial fish silage caused their rapid destruction. However, it was found infectious pancreatic necrosis virus survived in silage for long periods at the prevailing ambient temperatures in Scotland. The virus would be inactivated by heating the silage preparation to a temperature of 60°C for five hours or by the addition of the virucidal agent VIRKON at a concentration of 1/100 w/v. The use of ensiling fish farm wastes to hygienically dispose of infected materials such as mortalities and infected offals is discussed.

C.M.1990/F:53

Harboe, T., Næss, T., Naas, K.E., Rabben, H. and Skjolddal, L.H. (Institute of Marine Research, Austevoll Aquaculture Research Station, N-5392 Storebø, Norway)

AGE OF ATLANTIC HALIBUT LARVAE (*HIPPOGLOSSUS HIPPOGLOSSUS* L.) AT FIRST FEEDING

Halibut larvae at different ages (150 to 315 day-degrees) were transferred to outdoor start-feeding tanks each with two internal plastic bags (100 litre). The larvae were fed wild zooplankton. One bag was sampled after 24 hours, and the other after nine days. Numbers of larvae with food in the gut, without food in the gut and dead larvae, were counted for each larval age tested. The results showed that some larvae captured prey at an age of 150 day-degrees. However, at this age few larvae were alive after nine days. The fraction of larvae with food in the gut increased during the period tested. Survival after 24 hours and after nine days was highest when first feeding took place at a larval age of approximately 230 day-degrees.

A comparison of growth rate of halibut larvae (*Hippoglossus hippoglossus* L.) fed wild zooplankton and enriched *Artemia*. F:60

by

L.H. Skjolddal, T. Harboe, T. Næss, K.E. Naas, H. Rabben

ABSTRACT

Halibut larvae at an age of 267 day degrees post hatching, were reared through first feeding, outdoors in 100 l plastic bags. There were three feeding regimes: wild zooplankton, *Artemia* enriched on the algae *Isochrysis galbana* and *Artemia* enriched with "Super Selco". The larval growth was very low the first three weeks probably due to low temperature and high larval age at onset of exogenous feeding. At Day 16 the mean myotome height and dry weight were significantly higher for the group fed wild zooplankton, than for the *Artemia* groups, and the larvae fed Super Selco enriched *Artemia* had a significant higher myotome height and dry weight than the larvae fed *Isochrysis* enriched *Artemia*. There were no significant differences in larval size at Day 23. The low survivals of the two groups fed *Artemia*, could have been caused by the incomplete digestion of *Artemia*.

GREEN WATER IN LARVICULTURE - An experiment with natural phytoplankton in tanks for first feeding of halibut larvae (Hippoglossus hippoglossus L.) F:61

T. Næss, Ø. Bergh, T. Harboe, K.E. Naas, H. Rabben, L.H. Skjolddal.

At 232 day degrees, halibut larvae were transferred from indoor tanks to 1.7 m^3 outdoor tanks for first feeding. The number in each tank was approximately 750. Three tanks were continuously given algal suspension ("green water") and supplied nonenriched Artemia instar II. Six tanks were given filtered deep water ("clear water"). Three of the six were supplied nonenriched Artemia, and three were supplied Artemia prefed in green water.

Feeding incidence at day 3 was 47 % in green water and 0 % in clear water. Larval growth was significantly higher in green water compared to clear water, while no significant difference was found between the clear water groups given prefed and nonenriched Artemia. The mean myotome heights for all groups were 0.75 - 0.78 mm at day 7. At day 14 and 21, the mean heights were 1.49 and 1.86 mm in the green water group and 0.84 and 1.05 mm in the clear water groups. The survival rates were also much higher in green water. Out of a total of approximately 2250 halibut larvae in the green water tanks, 684 larvae were found alive at the end of the experiment. Corresponding numbers for the clear water tanks were 57 out of 4500. Preliminary results indicate no nutritional effect of the algae.

C.M.1990/F:63
Nortvedt, R.[1], Hansen, T.[2], Lunde, T.[3], and Skybakmoen, S.[3] ([1]Institute of Marine Research, Division of Aquaculture, P.O. Box 1870, Nordnes, N-5024 Bergen, Norway, [2]Institute of Marine Research, Division of Aquaculture, Matre Aquaculture Research Station, N-5198 Matredal, Norway, [3]Norwegian Hydrotechnical Laboratory, SINTEF Group, Klæbuveien 153, N-7034 Trondheim - NTH, Norway)

A MULTIVARIATE APPROACH TO INVESTIGATE GROWTH OF ATLANTIC SALMON PARRS AS FUNCTION OF WATER QUALITY IN REARING TANKS

Atlantic salmon parrs (Salmo salar) were reared under three different oxygen saturation levels. Growth and water quality was followed through seven months. A multivariate data program (SIRIUS) was used to test growth as a response to water quality. The water quality parameters were evaluated according to their growth response. Growth was positively correlated to oxygen saturation level, but also interactions with total ammonium content and water exchange rate were observed. The roles of interactions are discussed.

C.M.1990/F:64 - Ref.: Anadromous and Catadromous Fish Committee
Nortvedt, R.[1], Hansen, T.[2], Lunde, T.[3], and Skybakmoen, S.[3] ([1]Institute of Marine Research, Division of Aquaculture, P.O. Box 1870 Nordnes, N-5024 Bergen, Norway, [2]Institute of Marine Research, Division of Aquaculture, Matre Aquaculture Research Station, N-5198 Matredal, Norway, [3]Norwegian Hydrotechnical Laboratory, SINTEF Group, Klæbuveien 153, N-7034 Trondheim - NTH, Norway)

SMOLTIFICATION OF ATLANTIC SALMON IN DIFFERENT WATER QUALITIES AND SUBSEQUENT GROWTH IN SEA WATER, FOLLOWING DISTINCT TRANSFER STRATEGIES FROM FRESHWATER

Atlantic salmon parr were kept in four different fresh water qualities for seven months before smoltification, which was characterized by plasma chloride content after sea water challenge tests. Three groups were transferred directly to sea water. Three comparable sub-groups were transferred after a gradual change in oxygen content of fresh water. Growth and mortality of all groups were thereafter followed for six months in sea water.

Groups from fresh water with highest oxygen content and water exchange rate increased their biomass 5-6 times in sea water, whereas fresh water groups with low oxygen content and low water exchange rate only increased biomass 2-3 times in sea water. This emphasizes the importance of fresh water quality for the following success in sea water. Gradual increase in oxygen content seven weeks ahead of release into sea water had no influence on the subsequent success in sea water.

C.M.1990/F:72

Achenbach, L. and Froese, R. (Institut für Meereskunde, Düsternbrooker Weg 20, D-2300 Kiel 1, Federal Republic of Germany)

PRESENTATION OF A DATA BASE SYSTEM FOR INFORMATION ON AND DIAGNOSIS OF FISH DISEASES

A data base system is presented with detailed information on 131 fish diseases of importance to aquaculture and fisheries. About 150 macroscopic symptoms have been identified that can be used as diagnostic criteria. All diseases recorded in the system have been checked for these symptoms. In a test run with 20 diseases occurring in 26 fishes, the system was able to diagnose 17 diseases directly. The remaining three diseases could be identified to be one out of two possible diseases. On average, the use of six symptoms were necessary to achieve a reliable diagnosis. The test run supports the following hypotheses: (a) gross signs of a disease are well suited for an initial computer-aided diagnosis, (b) modern data base systems provide a fast and easy tool to approach a quick diagnosis with acceptable level of certainty, and (c) text descriptions and pictures of disease appearance taken from the literature can be successfully used to build an information and diagnosis system on fish diseases. The target user group for PC-aided identification system includes scientists, students, and administrators in the fisheries sector. The system is part of a large data base for biological data on fish and is currently being developed by the International Center for Living Aquatic Resources Management (ICLARM), Manila.

C.M.1990/F:73

Lein, I. and Holmefjord, I. (The Agricultural Research Council of Norway, Institute of Aquaculture Research, N-6600 Sunndalsøra, Norway)

LARVAL AGE AT FIRST FEED INTAKE IN ATLANTIC HALIBUT (HIPPOGLOSSUS HIPPOGLOSSUS)

The aim of this study was to identify at which developmental stage the Atlantic halibut larvae actively start feeding when offered food.

36 days after hatching, a group of larvae were offered food (algae and rotifiers) and examined for gut content after 48 hrs. 38 days after hatching and every other day thereafter, new groups of larvae were offered food and sampled after 48 hrs.

The highest frequency of larvae with algae in the gut was found between 210 and 250 day-degrees (days*temperature). The highest frequency of rotifiers in the larval gut was found among larvae offered food between 240 and 350 day-degrees. Larvae offered food at 360 d° died off before sampling.

The results in this experiment indicate that first feeding of Atlantic halibut should be initiated in the period from 200-240 day-degrees (42-54 days at temperature 4-5° C).

C.M.1990/F:74

Holmefjord, I. and Lein, I. (The Agricultural Research Council of Norway, Institute of Aquaculture Research, N-6600 Sunndalsøra, Norway)

NATURAL SPRING OF ATLANTIC HALIBUT (HIPPOGLOSSUS HIPPOGLOSSUS) IN CAPTIVITY

A broodstock of Atlantic halibut (Hippoglossus hippoglossus) was established in 1984 at The Institute of Aquaculture Research, Sunndalsøra, Norway. This broodstock has produced eggs by stripping since 1985. In 1989 and 1990, successful natural spawning has been registrated in one of the broodstock ponds (1 m deep, 10 m diam.). More than 30 liters of eggs were collected during the season of 1989, and high fertilization rates were registrated (up to more than 90%). Eggs from these spawnings have produced larvae of good quality. These larvae have later been fed and brought all the way through metamorphosis.

Bólkur G, Demersal Fish Committee, ið viðger botnfisk.

C.M.1990/G:3 - Theme Session O

Ajiad, A.M. (Institute of Marine Research, P.O. Box 1870, Nordnes, N-5024 Bergen, Norway)

VARIABILITIES IN STOMACH CONTENTS OF COD, COLLECTED BY DEMERSAL AND PELAGIC TRAWL IN THE SOUTHERN PART OF THE BARENTS SEA

Samples of Northeast Arctic cod stomachs were collected separately on demersal and pelagic stations at the same date in February 1986 and were analysed for length group 30-40 cm. The results indicate that the mean value of the stomach contents weight as well as the food composition are substantially different for the two types of gear. The Spearman rank correlation coefficient ($r_s = 0.109$; $t = 0.363$; $P > 0.1$) is not significant based on frequency data calculated from the diet of cod gathered by demersal and pelagic stations. These results question the accuracy of the consumption estimates which are based on a combination of field stomach contents weight and laboratory gastric evacuation rate studies. Therefore, the mean value of the stomach contents weight should be distributed on the fishing gears, in addition to seasons, sub-areas, fish size and time of the day.

MODELLING ENVIRONMENTALLY INDUCED CHANGE IN GROWTH FOR ATLANTIC CANADA COD STOCKS

/ G:24

by

R. B. Millar and R. A. Myers

ABSTRACT

Length at age data was used to fit a growth curve in which the predicted yearly increment in length is a function of the environmental factors prevelant during that year. The analysis was performed on seven NAFO regional cod stocks, with inclusion of the environmental factors population density and bottom temperature. These environmental factors were highly significant and explained as much as two thirds of the variability in the data.

EFFECT OF CAPELIN BIOMASS ON COD GROWTH

by

/G:25

R. B. Millar, L. Fahrig and P. A. Shelton

ABSTRACT

Length at age data was used to fit an evironmentally aware growth curve to cod from NAFO regions 2J, 3K, 3L. The predicted increase in length throughout a year was modelled as a function of three environmental factors – capelin biomass, cod biomass and bottom temperature. We found cod biomass and bottom temperature to be highly significant and they explained a large amount of the variability in the data. In contrast, the capelin biomass data was of no use in explaining variation in cod growth.

C.M.1990/G:32 - Ref.: Fish Capture Committee

Bjordal, Å. and Laevastu, T. (Institute of Fisheries Technology Research, P.O. Box 1964, N-5024 Bergen, Norway, Alaska Fisheries Science Center, 7600 Sand Point Way N.E. Seattle, WA 98115, USA)

EFFECTS OF TRAWLING AND LONGLINING ON THE YIELD AND BIOMASS OF COD STOCKS - NUMERICALLY SIMULATED

Numerical studies were conducted on the effects of trawl and longline catches on a cod stock and possibly yields from it.

Five year mean age composition of Pacific cod (Gadus macrocephalus) from the Bering Sea was used as initial age composition of the stock, which was normalized to 1 ton. Age specific Z (total mortality) was computed from this distribution and natural mortality was derived by subtracting fishing mortality from Z. Age compositions of catches were either prescribed from empirical data or created with fishing mortality coefficient (F), which was assumed constant with age after the age of full recruitment. The computations were done with different catch levels for six years assuming average constant recruitment. The computations were done with different catch levels for six years assuming average constant recruitment.

Essential results of this study are: a) the stock left in the sea decreases with increasing catch and reaches an equilibrium if recruitment and catches remain constant. With similar cath levels, this equilibrium is reached earlier with longline and is higher than that of trawl; b) if a given level of stock in sea is desired, higher annual catches can be taken with longlines than with trawl; c) by the same catch size, longlines remove more older and more piscivorous fish which is beneficial to recruitment if the latter is largely controlled by predation.

The above mentioned essential results indicate, among others, that some longline fishing might be allowed to continue when TAC for trawlers has been reached.

C.M.1990/G:33 - Ref.: Hydrography Committee
Hansen, B., Kristiansen, A., and Reinert, J. (Fiskirannsóknarstovan, Debessartrød, Fr-100 Torshavn, Faroe Islands)
COD AND HADDOCK IN FAROESE WATERS AND POSSIBLE CLIMATIC INFLUENCES ON THEM

Both cod and haddock are known to exist as separate stocks in Faroese waters. The paper documents existing knowledge on biology, stock variations and fishery for these stocks. As a framework for understanding the observed variations key features of the physical environment are discussed as well as time series of climatic variables which might influence the stocks.

C.M.1990/G:35
Bromley, P.J. and Last, J.M. (Ministry of Agriculture, Fisheries and Food, Directorate of Fisheries Research, Fisheries Laboratory, Lowestoft, Suffolk NR33 OHT, United Kingdom)
FEEDING IN THE TRAWL AND THE CONSEQUENCES FOR ESTIMATING FOOD CONSUMPTION IN NATURAL FISH POPULATIONS

In 1991, ICES intends to mount a trawl survey to sample the stomach contents of North Sea fish in order to estimate the feeding rates of the principal predators. Excessive feeding taking place during trawling will bias the stomach content data leading to an overestimation of feeding rate. During an investigation into the feeding of cod which had been caught by trawling in the Southern North Sea and Eastern English Channel, unusually large numbers of freshly ingested prey were noticed in the stomachs of some fish, leading to the suspicion that feeding in the trawl could be a serious problem. A method is presented here to estimate the level of feeding in the trawl, enabling this source of bias in the stomach content data to be eliminated. The results indicated that the problem was much more pronounced in cod caught in a mid-water trawl compared with a bottom trawl of the type to be used in 1991. However, the use of a cover over the cod end of a bottom trawl to separate the larger predators from the smaller prey appeared to effectively eliminate feeding in the trawl.

FEEDING OF HAKE AND MONKFISH IN THE NON-TRAWLABLE AREA OF THE SHELF OF THE CANTABRIAN SEA /G:45

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ABSTRACT

This paper presents a qualitative comparison of the diet of hake (Merluccius merluccius) and angler fish (Lophius piscatorius) on soft bottoms (the trawl fishing area) and hard bottoms (the gill-net and long-line area). Differences in diet are observed according to the size of the fish and the caracteristic prey on both types of bottom.

C.M.1990/G:49 - Ref.: Hydrography Committee
Loeng, H. and Gjøsæter, H. (Institute of Marine Research, P.O. Box 1870 Nordnes, N-5024 Bergen, Norway)
GROWTH OF O-GROUP FISH IN RELATION TO TEMPERATURE CONDITIONS IN THE BARENTS SEA DURING THE PERIOD 1965-1989

Since 1965, the International O-group fish survey has been carried out in the Barents Sea during late August and early September. The main purpose is to determine the year-class strength of some commercial fish species at an early stage in their life history. The present contribution is a preliminary study on the growth of the O-group during the first half year after spawning. Comparisons of lengths of cod, haddock, herring, and capelin strongly indicate similar variations from year to year. Since these species inhabit partly the same water masses the first six months, it is likely that the variation in growth depends on some common factors. One of these may be the temperature of the environment. The results so far indicate a relationship between the growth of larvae and temperature.

C.M.1990/G:51 - Theme Session O
Robb, A.P. (DAFS Marine Laboratory, Victoria Road, Aberdeen AB9 8DB, Scotland)
GASTRIC EVACUATION IN WHITING (MERLANGIUS MERLANGUS L.)

This paper describes the effect of fish size, meal size, temperature and prey type on gastric evacuation in whiting.

A linear evacuation model gave a good description of the data. Larger fish eliminated meals of a given size at a faster rate than smaller fish. When fish of similar size were given meals of different sizes, the larger meals were eliminated at a faster rate when expressed as g/h, but actually took longer to disappear by virtue of their size. Increase in temperature was accompanied by an increase in evacuation rates. No difference was found between the rates at which sandeel and clupeoid prey were evacuated.

LENGTH SELECTION DURING TRAWL SAMPLING AND ITS EFFECT ON ABUNDANCE INDICES BY AGE /G:55

(An evaluation of the Norwegian time series (1983-1989) of

bottom trawl indices on cod and haddock)

by

Olav Rune Godø
and
Knut Sunnanå

ABSTRACT

Investigations on length selectivity of the standard Norwegian bottom trawl has revealed that small cod and haddock are largely under-represented in the catch. To minimize the effect of length selection on abundance indices obtained from this trawl a new standard sampling trawl has been employed since January 1989. Based on parallel trawling experiments, factors for comparing catches from the two sampling equipments have been derived.

In this paper indices from 1983 to 1988 are converted, to indices comparable to abundance indices from the new sampling trawl. Changes in accuracy of indices by age due to changes in growth are examined, and the validity of combining indices from old and new sampling equipments into one time series is discussed.

ASPECTS OF GASTRIC EVACUATION IN THE ATLANTIC COD (Gadus morhua L.) G:69

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ABSTRACT

A model that describes single-meal evacuation in cod (Gadus morhua L.) fed whole prey has been developed. Different prey types were digested and evacuated at different rates. Gastric evacuation of the different prey types was a highly temperature-dependent process. Meal size and body weight of the cod were also important in modulating the rate of evacuation. The model was applied to sequential-meal situations, and it was found that the model adequately described the main trends in gastric evacuation under these conditions.

Bölkur H, Pelagic Fish Committee, ið viðger flotfisk.

C.M.1990/H:6 - Ref.: Statistics and Demersal Fish Committees
Sparholt, H (The Danish Institute for Fisheries and Marine Research, Charlottenlund Castle, DK-2920 Charlottenlund, Denmark)
USING GLM ANALYSIS ON THE IYFS HERRING DATA FOR THE NORTH SEA

A general linear model (GLM) was used to explain the variation in the IYFS log catch rates of 1-, 2-, and 3+-ringer herring in the North Sea and Division IIIa due to differences between years, vessels, time of the day, depth, area, and area*year interaction. All effects were significant at the 5% level and contributed to a large extent to the variation in the catch rates. Especially the vessel effect was large for 1-ringers indicating that some vessels are very inefficient in catching these herring. The differences between the catch rates at day and night were not large, about a factor 2 for 1-ringers and less for older herring. This suggests that night hauls in the herring standard area should be allowed in the survey. The correlation between the GLM index and the VPA number was high for 1-ringers and higher even than for the standard index. For 2- and 3+-ringers the correlations were less and the standard indices were more correlated to the VPA than the GLM indices.

C.M.1990/H:8
Isaev, N.A. and Belikov, S.V. (Polar Research Institute of Marine Fisheries and Oceanography (PINRO), 6 Knipovich Street, Murmansk, 183763, USSR)
RESULTS OF SOVIET INVESTIGATIONS ON BLUE WHITING IN THE NORTHEAST ATLANTIC IN SPRING 1989

The paper presents the results of Soviet hydroacoustic, biological and oceanographic observations carried out by R/V "Professor Marti" in the Northeast Atlantic. The materials collected allow to estimate abundance and biomass of the spawning stock of blue whiting in the area west of Ireland and British Isles and south of the Faroes.

A trawl-acoustic survey carried out during the period 25 March - 22 April on the spawning grounds of blue whiting west of Great Britain and Ireland and south of the Faroes over the area of 50.7 thousand square miles indicated that blue whiting abundance was 50.9 milliard fish and their biomass - 6.3 million tons. The densest concentrations of blue whiting were distributed west of Ireland on the northern slopes of the Porcupine Bank. West of Great Britain blue whiting were distributed in the shape of a narrow strip from the southern boundary to Hebrides. South of the Faroes no dense concentrations were registered. Fish of 26-32 cm in length (71.2%) at age 2-6 years (77.5%) of the 1987-1983 year classes made up the bulk of catches. It should be noted that there was a peculiarity of blue whiting distribution on the spawning grounds: in 1989 they were distributed at depths of 300-2000 m and somewhat westerly compared with 1988.

C.M.1990/H:11
Gerber, E.M. (Zaprybpromrazvedka, 5a, Dm. Donskoy Str., Kaliningrad 236000, USSR)
FISH RESOURCES IN OCEANIC AREAS OF THE NORTH ATLANTIC

In the recent decade, the Soviet fishery departments were active at developing the fisheries in the open oceanic waters of the North Atlantic. New areas for fishing the redfish and blue whiting were found. The scientific and fishing works in these areas have yielded extensive material on the biology, behaviour of the commercial fish and environmental conditions in their biotopes. Main results of the long-term observations and primary analysis of the data obtained are presented in this paper.

C.M.1990/H:14
Monstad, T. (Institute of Marine Research, P.O. Box 1870 Nordnes, N-5024 Bergen, Norway)
DISTRIBUTION AND GROWTH OF BLUE WHITING IN THE NORTH-EAST ATLANTIC

The distribution pattern of the blue whiting spawning stock has gradually changed in recent years, and concentrations are recorded more offshore and more to the south than before. The activity of the fleet with its shifting of fishing localities, gives knowledge of the blue whiting's migration route during the spawning season.

Also during the summer season, the distribution pattern has changed. The recordings of the highest concentrations have shifted from north and northwest of the warmer side of the Norwegian Sea to more southern parts. The acoustic estimates, which are considered as indices only, have decreased noticeably since the beginning of the 1980s. Some years they have been lower than the spawning stock assessments, and thus demonstrated that the total stock has not been properly covered during the feeding season.

In the period from 1983 to 1987, the structure of the blue whiting stock has been dominated by the strong of 1982 and 1983 year classes.

The growth of blue whiting, based on observed lengths as well as backcalculated lengths, is described for various years and year classes as occurring in various areas. Especially the 1982 and 1983 year classes when, as juveniles, being basis for the mixed industrial fishery in the North Sea.

The growth pattern varied significantly among the various year classes, and the rate increased with increasing years up to the 1978 year class. Thereafter, this effect was reversed up to the 1983 year class.

After the age of 5, the blue whiting growth pattern may diverse significantly from area to area, and off the Norwegian Coast blue whiting grow to a larger size than more offshore in the Norwegian Sea and west of the British Isles. However, while the growth in the Hebrides area was quite similar to that in the Norwegian Sea, it differed slightly from the growth in the Porcupine bank area. This indicates influence of blue whiting from other areas not taking part in the migration back to the Norwegian Sea. Analysis of annual zone measurements also indicates differences in the stock.

C.M.1990/H:15
Monstad, T. (Institute of Marine Research, P.O. Box 1870 Nordnes, N-5024 Bergen, Norway)
SOME BIOLOGICAL FACTORS OF BLUE WHITING IN THE NORTH-EAST ATLANTIC

Total mortality coefficients of blue whiting in the spawning area as well as in the feeding areas, were obtained for various years and for various year classes, by calculating the regressions of the natural logarithms of age frequency against age. Together with established fishing mortality coefficients, a mean value of 0.18 was calculated for the natural mortality coefficient; compared to 0.2 used by the Blue Whiting Assessment Working Group.

The index of the larval Anisakis parasite on the liver surface of blue whiting was found to increase with host's age. The burden of accumulation of this parasite did not seem to affect neither the condition factor nor the length growth in blue whiting. While the condition factor increased with age in the spawning area, the contrary was observed in the feeding area.

C.M.1990/H:16 - Ref.: Demersal Fish Committee

Bogstad, B. and Tjelmeland, S. (Institute of Marine Research, P.O. Box 1870 Nordnes, N-5024 Bergen, Norway)

ESTIMATION OF PREDATION MORTALITIES ON CAPELIN USING A COD-CAPELIN MODEL FOR THE BARENTS SEA

The Barents Sea capelin stock collapsed during the period 1983-1986. One of the main factors causing the collapse was a rapid increase in consumption of capelin by cod. Based on measurements of stomach evacuation rates in the appropriate temperature interval and data from a combined Soviet-Norwegian stomach sampling programme, predation mortalities are calculated by a simplified version of the IMR multispecies model for the Barents Sea - MULTSPEC. Cod-capelin interaction parameters and migration parameters for capelin in MULTSPEC are also estimated. The use of the predation mortalities calculated from the multispecies model in a single-species model used for capelin management is discussed.

C.M.1990/H:21 - Theme Session S

Corten, A. (Netherlands Institute for Fishery Investigations, P.O. Box 68, 1970 AB IJmuiden, The Netherlands)

THE CHOICE OF TARGET FISHING MORTALITY IN HERRING FISHERIES

In advising TACs for herring stocks, biologists have not been very consistent in the choice of a target fishing mortality. Over the years, several "biological reference points" have been used, but it has not been possible from a scientific point of view to express a clear preference for one of them. Also, the reference points used are not constant values, but they change from stock to stock, and from year to year.

Management advice would become more transparent and consistent if biologists admitted that optimum target Fs for each stock cannot be defined within sharp boundaries, but that an arbitrary choice has to be made within a range of reasonably safe values. In selecting such an arbitrary option, managers and biologists should not only consider yield/recruit or stock/recruitment relationships, but also recruitment variability, market demand for particular size categories, density-dependent growth, and species interactions. Considering our limited knowledge about most of these aspects, there is no point in arguing about subtle differences in target F for each individual stock.

It is suggested that the choice of target F is restricted to a limited number of rounded F-values, say 0.20 and 0.30. If one of these options is selected, management should stick to it in future years, until empirical evidence shows the need for a revision of target F.

International Council for the Exploration of the Sea

C.M. 1990/H:30
Pelagic Fish Committee

ON THE INTERTIDAL SPAWNING OF BALSFJORD HERRING (CLUPEA HARENGUS L.)

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ABSTRACT

Balsfjord herring (70° N) are meristically and genetically distinct from Atlanto-Scandian herring. They spawn over a few nights in spring, in the intertidal and upper sub-littoral zones down to about 3 m depth, and have a distinct preference for seaweed-substrates for egg attachment. In terms of latitude, water temperature at spawning, and meristic and genetic characteristics, Balsfjord herring appear to most closely resemble, among continental European spawners, the White Sea stock. Age-at-spawning (4-9 years, with 50% point of 6-7 years) is similar to Norwegian spring spawning herring, but length-age-at-age and weight-at-length are lower in Balsfjord herring. Although Balsfjord has its own indigenous populations of herring as well as beach-spawning capelin, these spawn at different sites and times, have little overlap in their prey, and lie towards different ends of the r- and K-selection spectra, thus probably reducing competition.

C.M.1990/H:33

Jacobsen, J.A. (Fisheries Laboratory of the Faroes, Nóatún, FR-100 Tórshavn, Faroe Islands)

ACOUSTIC SURVEYS ON BLUE WHITING NORTH OF THE FAROES IN AUGUST/SEPTEMBER 1988 AND 1989

This paper describes the results from two acoustic surveys on blue whiting in the Norwegian Sea, one in August 1988 and one in August/September 1989. The blue whiting is distributed over a wide area in the autumn on its feeding grounds in the Norwegian Sea. These investigations were limited to estimate only the part of the blue whiting stock inside and close to the Faroese fishing zone.

A total of 335 thousand tonnes was recorded in the surveyed area in 1988 and 357 thousand tonnes in 1989. In the 1988 survey, the 1983 and 1985 year classes dominated and were found to constitute 35% of the total estimate. In the 1989 survey, the 1989 year class dominated totally, comprising 97% of the total estimate, especially in the western and south-western area.

C.M.1990/H:34
Jacobsen, J.A. (Fisheries Laboratory of the Faroes, Nóatún, FR-100 Tórshavn, Faroe Islands)

A SURVEY ON HERRING SOUTH OF THE FAROES IN JUNE 1990

During a survey in June 1990 with the Faroese research vessel "Magnus Heinason", herring was found to be distributed over a wide area south and south-east of the Faroes. The fish was prespawning autumn spawning herring with an average vertebral count of 56.4 and a mean length of 29 cm. Most of the examined herring were 4-ringers (42%), and 22% were 5-ringers.

A method to estimate the density of observed herring schools near the sea surface with a side-looking 38 kHz sounder in a towed body was tried, the transducer was connected to an integrator. With further development the method might give better estimates of herring schools near the sea surface than standard acoustic techniques with hull mounted transducers, due to larger sampling volume in the uppermost layer.

International council for
the Exploration of the Sea

C.M. 1990/H:37
Pelagic Fish
Committee

RESULTS OF THE BLUE WHITING OTOLITH EXCHANGE

by

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ABSTRACT

At the Blue Whiting Assessment Working Group, it was agreed to carry out an otolith exchange programme to solve the ageing problems pointed out by ACFM.
A sample of 115 otoliths from Division IXa was exchanged, and seven countries are taking part in the exchange, although it has not yet been completed. One otolith from each fish was sectioned and the other preserved in aqueous solution. In the whole otoliths a tendency to lose one or two early rings was observed, and in the sectioned otoliths the presence of false rings was the cause of misreading. A combination of both methods would probably improve the age determinations, but is unfortunately time consuming.
The agreement between the readers was in general low, from both sliced and whole otoliths.The ANOVA with a significance level of 5% showed that the mean age of the sample is different for various readers, and the Tukey test showed that there are no significant differences between three readers, at the same significance level.
Considering the importance of ageing in the assessment, new investigations are needed to improve the agreement, and it is suggested that further samples are exchanged, or that an otolith workshop should be convened.

C.M.1990/H:38

Belikov, S.V.[1], Mahon, D.M.[2], and Molloy, J.[3] ([1]Polar Research Institute of Marine Fisheries and Oceanography (PINRO), 6 Knipovich Street, 183763, Murmansk, USSR, [2]University College, Dublin, Ireland, [3]Fisheries Research Centre, Abbotstown, Castleknock, Dublin 15, Ireland)

RESULTS OF BLUE WHITING INVESTIGATIONS IN THE NORTHEAST ATLANTIC IN SPRING, 1990

This paper describes the results of the 1990 hydroacoustic and biological investigations on the abundance and distribution of the blue whiting population off the west coast of Ireland. These investigations have now been carried out for a number of years and the 1990 surveys were conducted using the Soviet R/V "Pinro".

Firstly, an acoustic survey, coupled with a series of trawl stations, was completed between 19 March and 6 April, in a south-north direction. In this area of 28,898 square miles, the biomass of blue whiting was calculated to be 4.469 million tonnes with a total abundance of 31.650 million specimens. The length distribution of blue whiting during this stage was 18 to 42 cm with fish of length 30 cm predominant. The 1986 year class was the most prevalent year class during this survey.

An ichthyoplankton and hydrographic survey constituted the second part, begun on 22 April and completed on 5 May, also in a south-north direction. The blue whiting egg and larval distribution was similar to that observed in 1988, but was of a lower total abundance.

International Council for the Exploration of the Sea

C.M. 1990/H:39
Pelagic Fish Committee

Results of research on blue whiting to the west of Irish coast in spring 1989

by

N.A.Issev

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D.Minchin

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ABSTRACT

Materials of hydroacoustic and biological researches on blue whiting abundance and biomass to the west of Irish coast collected by the Soviet RV "Professor Marti" are presented in the paper.

The survey was conducted in general direction from south to north from 25 March to 8 April. The area of 31 thou.mile^2 was investigated. Blue whiting were distributed over the isobaths from 300 to 2000 m in a form of "path"with a vertical development of 20-100 m in the depths of 300-600 m. Total abundance made up 36.6 x 10^9 spec. and biomass - 4.6 x 10^6 t. The densest concentrations were registered to the south and north of the Porcupine Bank.

Bólkur K, Shellfish Committee, ið viðger botndjór.

C.M.1990/K:2

Meeren, G.I. van der[1], Svåsand, T.[2], Grimsen, S.[3], Kristiansen, A.[1] and Farestveit, E.[2] ([1]Institute of Marine Research Austevoll Aquaculture Research Station, N-5392 Storebø, Norway, [2]Institute of Marine Research, Division of Aquaculture, Post Box 1870 Nordnes, N-5024 Bergen, Norway, [3]Institute of Marine Research, Kyrksæterøra Lobster Hatchery, N-7200 Kyrksæterøra, Norway)

LARGE- SCALE RELEASE EXPERIMENT OF JUVENILE LOBSTERS, HOMARUS GAMMARUS, IN NORWAY

A large-scale spring release of juvenile lobsters, Homarus gammarus, was conducted at Kvitsøy, southwestern Norway in March 1990. The lobsters, 14,700 one and a half year old and 8,700 six months old, were tagged internally with coded microtags at the hatchery. The lobsters were transported by road and air to the release site and acclimated to sea water of 6°C, 15 to 60 minutes prior to release. The lobsters were released from small boats in shallow water, with about one lobster per m shoreline. Under-water video takings showed that the lobsters were alert, but very calm after release. They moved into shelter within the first hour. No inter-specific aggression or predator fish were observed.

A preliminary report on the reproductive cycle of *Nephrops norvegicus* at the Faroes. K:3

by

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and
H.Eiriksson[2]

Abstract

The paper describes data on maturity stages of ovaries and external eggs collected at the Faroes by trawl in 1986 and 1990 and by creel in 1988-1989.

There is some evidence of biennial spawning amongst the *Nephrops* population, similar to those described for some other northerly stocks like Iceland in particular.

C.M.1990/K:4

Berenboim, B.I., Mukhin, S.G. and Sheveleva, G.K. (Polar Research Institute of Marine Fisheries and Oceanography (PINRO), 6 Knipovich Street, Murmansk, 183763, USSR)

SOVIET INVESTIGATIONS OF SHRIMP PANDALUS BOREALIS IN THE BARENTS SEA AND OFF THE SPITSBERGEN IN 1989

The Soviet trawl survey of shrimp Pandalus borealis stocks was carried out in the Barents Sea from 30 April to 16 May, off the Spitsbergen from 25 June to 11 July 1989. Methods of survey published earlier were used.

The trawl survey was conducted in the area from 71° to 74°N between 30° and 36°E, from 74° to 76°N between 25° and 34°E, and also in the areas adjacent to the Spitsbergen archipelago.

Shrimp catches consisted mainly of males. However, the portion of females was also considerable and accounted for 38% of total number of shrimps in the Barents Sea which was much higher as against the corresponding index in 1988. Three-year-old shrimps with carapage length of 17-20 mm made up the bulk of catches over the whole area surveyed.

Juvenile cod and haddock by-catches decreased when compared with 1988.

Shrimp biomass and numbers were estimated at 386 ± 55 thou. t and 89 ± 30 x 10^9 spec. in the Barents Sea area, and at 91 ± 15 thou. t and 18 ± 3 x 10^9 spec. off Spitsbergen. Biomass increased in most areas as against that of 1988.

TOTAL LIPID CONTENT, AND LIPID AND FATTY ACID COMPOSITION OF THE DEEP-WATER PRAWN PANDALUS BOREALIS FROM BALSFJORD, NORTHERN NORWAY: GROWTH AND FEEDING RELATIONSHIPS K:10

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ABSTRACT

Variations in total lipid content (g of lipid, and as %'s of wet- and dry body weights) are described for 23 age-groups of the prawn Pandalus borealis, ranging from eggs to 52 month-old adults. The relative contribution of age and seasonal (month) factors to the overall variability are quantified. The lipid class composition of selected sizes/ages of prawn are examined, and the presence of fatty acid food-chain markers related to knowledge of the prawns' gut contents and the availability of suitable food in the fjord. The results are discussed in relation to the life-history and growth cycles of P. borealis, and relevant features of the production cycle in the seasonally fluctuating fjordic environment at high latitude.

C.M.1990/K:11 - Ref.: Marine Environmental Quality and Mariculture Committees

Bodoy, A., Garnier, J.[1], Razet, D.[2], and Geairon, P.[1] ([1]IFREMER Laboratoire Régional de Conchyliculture, B.P. 133, F-17390 La Tremblade, France, [2]IFREMER, Laboratoire Ecosystème Conchylicole, B.P.133, F - 17390 La Tremblade, France)

MASS MORTALITIES OF OYSTERS (CRASSOSTREA GIGAS) DURING SPRING 1988 IN THE BAY OF MARENNES-OLERON, RELATED TO ENVIRONMENTAL CONDITIONS

Mass mortalities of oysters were recorded in the South of the Bay of Marennes-Oleron, during Spring 1988. The percentages of mortality averaged 50% and reached up to 90% in some areas of bottom culture. The losses were estimated to 7,800 t. This paper presents the results of the investigations carried out in several fields. Among them, pathological examination revealed that no pathogenic agent or parasitic infestation could be evoked to explain these mortalities. Analyses of pollutants were either negative, or the concentrations were far below the toxicity levels. Climatological and hydrological observations showed that rainfalls were twice more abundant than the average, for a period of 6 months preceding the mortalities. The salinity was low and fluctuating in the area, and the temperature was warmer than the average during the same period. Phytoplanktonic blooms were recorded only by the end of May, later than usual. These ecological changes resulted in a poor physiological condition of the oysters, which became critical for the grounds located at the south of the bay. Both their high tidal position and low quantities of phytoplankton are characteristic of this area. The high densities of oysters in the parks were also evoked as contribution to the establishment of such critical conditions.

C.M.1990/K:13 - Ref.: Mariculture Committee

Bannister, R.C.A.[1], Thompson, B.M.[1], Addison, J.T.[1], Lovewell, S.J.[1], and Howard, A.E.[2] ([1]Ministry of Agriculture, Fisheries & Food, Directorate of Fisheries Research, Pakefield Road, Lowestoft, Suffolk NR33 0HT, United Kingdom, [2]Ministry of Agriculture, Fisheries & Food, Fish Diseases Laboratory, The Nothe, Weymouth, Dorset DT4 8UB, United Kingdom)

THE 1989 RESULTS FROM A LOBSTER STOCK ENHANCEMENT EXPERIMENT ON THE EAST COAST OF ENGLAND

Between 1983 and 1988, approximately 50,000 hatchery reared stage XII lobsters (Homarus gammarus L.), each containing a coded wire microtag, were released by MAFF diving teams onto various patches of lobster habitat in Bridlington Bay on the east coast of England. Since 1987, we have visited the coast during the main lobster season from mid-July to September, and have developed techniques for investigating the proportion of microtagged survivors present both in selected commercial catches of undersized lobsters caught at sea at known locations, and in a substantial sub-sample of the total legal sized landings at the quayside.

In 1989, there were 110 recaptures of microtagged animals to add to the 26 caught in 1988. For these recaptures the paper summarises the available information on release date, recapture position, growth, and the rate of recapture.

THE POTENTIAL OF AERIAL PHOTOGRAPHY FOR ESTIMATING INTERTIDAL STOCKS OF MUSSELS (*Mytilus edulis*) IN THE WASH, ENGLAND

K:14

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ABSTRACT

Aerial photography and an image processing system were used to estimate the area, and the proportional mussel cover, of an intertidal mussel bed in two successive years. The photographic estimates agreed well with ground-truth measurements obtained by transect survey methods, including use of compass bearings and a radio navigator to map bed area.

Estimates of standing stock biomass on the test area were obtained by combining aerial data with quadrat sampling of mussel biomass density. The results compared well with the total catch removed by fishing.

The suitability of aerial photography for extensive survey of mussel stocks is discussed.

C.M.1990/K:20

Héral, M.[1], Rothschild, B.J.[2] and Goulletquer, P.[2] ([1]Institut Francais de Recherche pour l' Exploitation de la Mer (IFREMER), Laboratoire Ecosystèmes Conchylicoles (LEC), BP 133, 17390 La Tremblade, France, [2]University of Maryland, Center for Environmental and Estuarine Study, Chesapeake Biological Laboratory (CBL), Box 38, Solomons, Maryland 20688-0038, USA)

DECLINE OF OYSTER PRODUCTION IN THE MARYLAND PORTION OF THE CHESAPEAKE BAY: CAUSES AND PERSPECTIVES

The historical landings of the oyster production are described for the Maryland part of the Chesapeake Bay. The different trends are analysed concurrently with the main events and management strategies which occurred on the bay. Three main periods are identified:

- the greatest fishery from 1840 to 1890 with a large overfishing and the destruction of the oyster habitat caused by the oyster gears, the landings of oyster reached at this period 600,000 tonnes in total weight,
- the decrease and stable landings from 1900 to 1980 due to the failure of the reseeding plan connected to the heavy sedimentation and the anoxic summer conditions did not permit to pass beyond 80,000 tonnes,
- the large decrease of the production (1981-1988) is due to high mortalities related to diseases (MSX and Perkinsus marinus) predation and management practices. The landings since 1986 remained under 15,000 tonnes.

Alternative strategies for restoration of oyster production in the Chesapeake Bay are presented.

Spatial patterns of variability in length frequency distributions of *Nephrops* in the Irish Sea. K:21

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Dublin 15, Ireland.

SUMMARY

Spatially contiguous patterns in the variability of length frequency distributions of *Nephrops* in the Irish Sea were detected by cluster analysis. Inter cluster differences were interpreted as spatially variable rates of growth and mortality. Areas supporting high growth rates of males and suspected high growth rates of females also had a significantly lower proportion of immature females and lower *Nephrops* population density. Environmental conditions that may generate these patterns are discussed.

The Irish Fishery for Nephrops on the Porcupine Bank K:22

ABSTRACT

Sampling of the exploited stock of Nephrops on the Porcupine Bank grounds shows marked differences insize composition between eastern and western areas fished by Irish vesels in 1990. Sample parameters are compared and age determination by fitting of normal curves to polymodallengthdistributions carried out to obtain values of L_∞ and K.

C.M.1990/K:23 - Ref.: Mariculture Committee
Andersen, S. and Naas, K.E. (Institute of Marine Research, Austevoll Aquaculture Research Station, N-5392 Storebø, Norway)

GROWTH OF SCALLOP JUVENILES (PECTEN MAXIMUS L.) IN AN ENRICHED SHALLOW SEAWATER BASIN

The aim of this work was to see if a shallow, enriched seawater basin was a suitable location for scallop culture. Growth of great scallop juveniles (Pecten maximus L.) was compared with two open sea locations, and the mean growth rate is described for 23.1-29.5 mm juveniles in three intervals from early April to late September 1989. In 1990, the mean of individual growth rate is described for 30-65 mm juveniles in April, May, June and July. Growth was measured as increase in shell height. Temperature, salinity and particulate organic material, POM, (1990) were recorded twice every week. Phytoplankton (1989) was observed weekly.

Mean growth rate per individual (mm/30 days) in 1989 was, relative to the other locations, higher in the basin in April-May, approximately equal in May-July and lower in July-September. The relative high growth rate in April-May coincided with relative higher temperature and phytoplankton biomass. The low growth rate in the basin was observed in a period of equal temperature relative to the other locations, higher phytoplankton biomass, but with large variations in salinity (25-31 ppt). In 1990, there were no significant difference in mean of individual growth rate between the locations, except for June. The low growth rate and high mortality observed in the basin this month coincided with very high POM values (mean = 17 mg/l, maximum = 31 mg/l).

The conclusion so far is that the seawater basin is suitable for culturing scallop juveniles, given a certain manipulation with salinity, fertilization and water circulation.

Bólkur L, Biological Oceanography Committee, ið viðger æti og gróður.

C.M.1990/L:46 - Theme Session Q - POSTER

Jones, R. and Henderson, E.W. (DAFS Marine Laboratory, Victoria Road, Aberdeen AB9 8DB, Scotland)

THE DETRITAL CYCLE AND ITS INTERACTION WITH HIGHER TROPHIC LEVELS

Attempts to simulate an annual nitrogen cycle show that for semi-realistic results, a minimum of four nitrogen compartments is essential. These are: animals, phytoplankton, inorganic nitrogen, and dead organic nitrogen.

Of these four components, dead organic nitrogen makes up at least 80% of the total nitrogen in the system. The formation and breakdown of this material, therefore, has a considerable influence on the living components of the system. For example, during the productive season, build-up of dead organic nitrogen takes place at the expense of nitrogen available for living matter, and sets a limit to the effective level of animal production.

After the spring bloom, there is typically a period during which the relative magnitudes of the four nitrogen compartments do not vary significantly. During this period in particular, the properties of the system as a whole are dependent on the dynamic balance between the various nitrogen compartments.

Very important too, is the uptake of inorganic nitrogen by micro-organisms. This nitrogen is required to manufacture proteins by those micro-organisms that utilize the soluble organic carbon that is released by phytoplankton for inorganic nitrogen at a time when inorganic nitrogen concentrations are typically low. The resultant flow diverts nitrogen to the dead organic compartment at the expense of higher trophic levels.

The magnitude of this flow can be calculated from simulation studies or steady state calculations. These studies indicate that inorganic nitrogen uptake by micro-organisms must be of the same order of magnitude as uptake by phytoplankton, during the summer.

A better understanding of the formation and breakdown of dead organic matter is, therefore, essential for understanding how the ecosystem works.

C.M.1990/L:98

Clemmensen, C. (Institut für Hydrobiologie und Fischereiwissenschaft, Universität Hamburg, Olbergsweg 24, D-2000 Hamburg 50, Federal Republic of Germany)

IMPROVEMENTS IN THE FLUORMETRIC DETERMINATION OF THE RNA- AND DNA CONTENT IN INDIVIDUAL MARINE FISH LARVAE

The RNA/DNA ratio is a useful indicator of the nutritional condition of fish larvae. The presented analytical procedure is an improvement of Clemmensen's (1988) methodology, which involves purification of fish larvae tissue homogenates and subsequent fluorescence-photometric measurement using specific nucleic acid dyes. The modifications concern the homogenization and nucleic acid extraction procedures. A "Shaking mill" was compared to a potter Elvehjem microhomogenizer and a reduction in the washing and puricifaction steps was achieved.

Treatment of samples with ribonuclease A and subsequent fluorescence measurement using ethidium bromide was given preference compared to the DNA-bisbenzimidazole determinations due to problems arising from high self-fluorescence of the samples and the influence of "quenching" substances disturbing the DNA-bisbenzimidazole determinations. Different RNase concentrations and their influences on RNA and DNA were checked. Recovery rates of standard RNA and DNA "spikes" were determined. Fish larvae samples were analyzed with the previous and the improved modified procedure and a correction factor to compare results measured with the two procedures was calculated. With the presented method the physiological condition of individual larvae and the amount of variability can be determined.

C.M.1990/L:99

Oeberschär, B. and Clemmensen, C. (Institut für Hydrobiologie und Fischereiwissenschaft, Universität Hamburg, Olbergsweg 24, D-2000 Hamburg 50, Federal Republic of Germany)

A COMPARISON OF THE NUTRITIONAL CONDITION OF HERRING LARVAE AS DETERMINED BY TWO BIOCHEMICAL METHODS - TRYPTIC ENZYME ACTIVITY AND RNA/DNA RATIO MEASUREMENT

Two biochemical methods for measuring larval fish condition - the tryptic enzyme activity and the RNA/DNA ratio measurement - were applied to herring larvae from the Schlei Fjord. These wild caught larvae were transferred to the laboratory and kept under defined conditions. The objective of the investigations was the comparison of both indicators in reaction to short-term changes in food availability and long-term starvation periods.

The presented results confirm the assumption that both indicators react differently in the short-term range. The tryptic enzyme activity reacts fast on changing food availability, whereas changes in the hour scale as reactions to food uptake cannot be measured with the RNA/DNA ratio. In the long-term range, the reaction of the analyzed parameters corresponds well. Both methods reflect the difference in the nutritional condition by a drastic decrease for the tryptic enzyme activity as well as for the RNA/DNA ratio in larvae deprived of food for longer time intervals. The results of the study demonstrate the usefulness of both methods monitoring nutritional condition of fish larvae in field samples.

SPAWNING STRATEGY AND A MECHANISM FOR ADAPTIVE LARVAL PRODUCTION IN ARCTO-NORWEGIAN COD.

L:100

by

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ABSTRACT

The Arcto-Norwegian cod is spawning in the temperature stable Atlantic water, and the eggs ascend into the more temperature variable coastal water. Changes in time of peak spawning, up to 10 days within the last 60 years, are caused by changes in the cod's age composition, peak spawning of first-time spawners being somewhat delayed. In contrast, the peak spawning in the coastal water of Calanus finmarchicus, whose nauplii are the almost exclusively food organism for the first feeding cod larvae, vary with more than 40 days due to temperature variations. It is a clear tendency for the majority of nauplii abundance peaks to be situated ahead of the peak first feeding cod larvae, especially during warm years.

The temperature covariate in the spawning areas in the Norwegian coastal waters and the feeding areas of cod in the Barents Sea. High temperatures during the egg and larval stages favour the feeding condition of the larvae hatched first, since the concentration of nauplii is higher in the first part of the larval period. These larvae from the larger, high fecund cod females, are the largest and probably the most viable larvae produced during the season. During periods of decreasing temperatures in the feeding areas and the spawning sites, the production of viable larvae is more variable.

High temperatures also improve and extend the feeding areas in the Barents Sea, giving support for larger year-classes. In both temperature regimes the age compostition of the spawning population of Arcto-Norwegian cod will effect the degree of match between the production cycle of nauplii and first feeding cod larvae. The spawning strategy of Arcto-Norwegian cod in relation to Calanus finmarchicus can be named a modified match/mismatch hypothesis, ensuring a adaptive larval production to varying temperature regimes of the feeding areas of the cod.

Bólkur M, Anadromous and Catadromous Fish Committee, ið viðger laks og tilikan fisk.

C.M.1990/M:17

Fjallstein, I. (Fishery Laboratory of the Faroes, Torshavn, Faroe Islands)

RELATIVE DECLINE OF SAMPLE TOTAL WEIGHT IN SEA WATER CHALLENGE TESTS AS A SMOLT QUALITY CRITERION

Atlantic sample (S. salar) parr had an average weight of 40 g in October the year before smoltification. Light and temperature were natural from July. The salmon were tested in 24 hours sea water challenge tests (SWCT) every fourth week from October to May and every second week from medio May to medio July. The fish were weighed as a group before every 24 hours SWCT. After the SWCT, length, weight and sex were recorded individually, and blood samples were taken for chlorid titration. The relative decline in sample total weight was 12% in November, 6% or less medio May and more than 10% in July. Used together with appearance and condition factors, decline in sample total weight seems to be a simple, reliable and quick method to decide smolt quality.

Samandráttir úr Minisymposium um árin á botndjór í Norðsjónum.

C.M.1990/Mini:1

Eleftheriou, A.[1] and Heip, C.[2] ([1]Marine Laboratory, P.O. Box 101, Victoria Road, Aberdeen AB9 8DB, Scotland, [2]Delta Institute for Hydrobiological Research, Vierstraat 28, 4401 EA Yerseke, The Netherlands)

PLANNING AND EXECUTION OF THE NORTH SEA BENTHIC SURVEY

Benthic studies in the Northern North Sea in the early 1980s identified important gaps in our knowledge of quantitative and qualitative aspects of the North Sea benthos and its role in the North Sea food web. The setting up of an ICES North Sea Benthos Working Group had as its remit to review the state-of-the-art in benthic studies in the North Sea and to make recommendations for cooperative research in the North Sea according to the priorities identified by the ICES representatives.

The historic evolution of the Benthos Working Group over nine years of its existence is traced through its achievements in international cooperation and its culmination in a cooperative study of the North Sea sedimentary environment and its benthic communities on a synoptic basis, which is briefly described.

Mini: 2

THE BENTHIC INFAUNA OF THE NORTH SEA: SPECIES DISTRIBUTION AND ASSEMBLAGES

by

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ABSTRACT

Previous investigations on the benthic fauna of the North Sea were carried out only in limited areas of the North Sea. In 1986 participants of the Benthos Ecology Working Group of ICES conducted a synoptic mapping of the infauna of the southern and central North Sea. Together with a recent mapping of the infauna of the northern North Sea by ELEFTHERIOU & BASFORD (1989) this provides the data base for the description of the benthic infauna of the whole North Sea in this paper. Division of the infauna into assemblages by TWINSPAN analysis separated northern assemblages from southern assemblages along the 80m depth contour. Assemblages were further separated by the 50m and 100m depth contour as well as by the sediment. These divisions into assemblages are caused by corresponding patterns of species distributions. Besides widely distributed species, cold water species do not occur farther south than the northern edge of the Dogger Bank, which corresponds to the 50m depth contour. Warm water species were not found north of the 80-100m depth contour. Some species occur on all types of sediment but most are restricted to a special sediment and therefore these species are limited in their distribution. The factors structuring species distributions and assemblages seem to be temperature, the influence of different water masses, e.g. Atlantic water and possibly the food supply to the benthos.

C.M.1990/Mini:3

Kröncke, I. (Biologische Anstalt Helgoland, Notkestr. 31, D-2000 Hamburg 52, Federal Republic of Germany)

MACROFAUNA STANDING STOCK OF THE DOGGER BANK. A COMPARISON: 1950-1954 VERSUS 1985-1987

During April/May 1985-1987, some of URSIN's (URSIN, 1960) stations on the Dogger Bank from April/May 1951-1952 were revisited. Following changes in the macrofauna communities were observed:

Species number rose; diversity declined; opportunistic, short living species increased; long living Mollusca decreased; rise of biomass in order of 2.5 to 8 times; low similarity between stations from the fifties and the eighties.

Some hypotheses concerning the interpretation of the observed changes, such as increasing eutrophication and pollution, are given for the changes in the macrofauna distribution on the Dogger Bank betweeen 1951-1952 and 1985-1987.

C.M.1990/Mini:5

Niermann, U. (Biologische Anstalt Helgoland, Notkestrasse 31, D-2000 Hamburg 52, Federal Republic of Germany)

OXYGEN DEFICIENCY IN THE SOUTH EASTERN NORTH SEA IN SUMMER 1989

In summer 1989, an oxygen deficiency occurred in the south eastern North Sea, north of the White Bank at the eastern edge of the postglacial River Elbe Valley. The macrofauna in this region with predominantly muddy, fine sandy substrates belongs to the Amphiura filiformis-community.

The development of the oxygen deficiency had been observed by Danish and German Research vessels from June to October 1989. Oxygen values dropped below 2 mg O_2 dm^{-3} from mid-September to the beginning of October. The oxygen deficiency was terminated by heavy storms. The area affected by low oxygen values and the damage incurred by the fauna were small in comparison with those affected and caused by the large-scale oxygen deficiencies in the south eastern North Sea in years 1981-1983. Nevertheless, the effects showed the same pattern:

Almost all fish had disappeared from the sub-thermocline waters of the oxygen deficient areas. Dredge samples showed that due to the lack of oxygen the infauna had left the sediment. The sea urchin Echinocardium cordatum, a species which is very sensitive to low oxygen values, suffered the heaviest losses. About 10% of the sea urchins lying on the sediment were dead (≈ 190 t wet weight in the whole area). After the storm period under nearly saturated oxygen conditions, the surviving animals migrated back into the sediment. Dredge samples collected in mid-October displayed no differences when compared to samples from before the oxygen deficiency. Neither dead animals nor skeletons of the sea urchins were found.

C.M.1990/Mini:7

Kingston, P.F. (Institute of Offshore Engineering, Heriot-Watt University, Riccarton, Edinburgh EH14 4AS, United Kingdom)

IMPACT OF OFFSHORE OIL PRODUCTION INSTALLATIONS ON THE BENTHOS OF THE NORTH SEA

Biological monitoring around the offshore oil production platforms has now been going on for over a decade and a half. During that time, there have been many changes in the approach to monitoring the impact of oil field development resulting from the change from predominantly exploration and production well drilling to oil production and from the change in government legislation relating to drilling activity and monitoring. In addition, there has been an unbroken increase in overall activity which looks like continuing well into the future.

It was originally thought that the impact on the benthos would be much more widely spread than has been subsequently shown, so that early monitoring studies featured wide ranging sampling grids. After the first exploration phase, when the production platforms became operational, it was found that gross impact was, for the most part, confined to the immediate vicinity of the installations and so the sampling approach was modified to concentrate more on the inner zones.

The most common approach currently used is to sample the seabed by 0.1 m^2 grab sampler on a transect along the prevailing current direction. Samples are usually taken at 200, 500, 800, 1200, 2500 and 5000 metres from the installation.

Gross effects on the benthic communities are detectable up to 500 - 1,000 metres from the platform, the precise extent depending upon the drilling history of the platform and the type of drilling muds used.

In the region of gross effect, two types of community response have been observed, one in which there is low faunal diversity but high individual abundance and the other in which low diversity is parallelled by low abundance. The former response suggests an organic enrichment effect whilst the latter, either a direct physical effect or a toxic effect. Diversity can be shown to be reduced below background levels by concentrations of oil in sediment around 50 - 60 ppm (by IR analysis). Certain more sensitive species appear to be affected at even lower concentration (4 ppm).

There is recent evidence to suggest that levels of sediment hydrocarbons may have significantly increased at distances greater than 10 km from production platforms in the northern North Sea suggesting that it may be difficult to find anywhere in the region that is totally free from contamination.

C.M.1990/Mini:8

Huys, R. and Heip, C. (Delta Institute for Hydrobiological Research, Vierstraat 28, 4401 Yerseke, The Netherlands)

MEIOFAUNA OF THE NORTH SEA BENTHOS SURVEY

During a synoptic survey carried out in April-May 1986, one hundred and seventy-one localities were sampled in the North Sea area delimited by the Strait of Dover in the south and approximately by the 100 m isobath in the north. Meiofauna includes Nematoda, Harpacticoida, Turbellaria, Gastrotricha, Polychaeta, Oligochaeta, Priapulida, Kinorhyncha, Ostracoda, Halacarida, Isopoda, Tanaidacea, Bryozoa, Hydrozoa, Sipunculida, Echiurida, Nemertini and Tardigrada. Nematodes are virtually the dominant group in all stations, their densities ranging from 61 to 4,167 ind/10 cm^2. Only in the Southern Bight harpacticoids sometimes represent the dominant meiofaunal taxon.

A specialized community is found in the central part of the Southern Bight (south of $53^0 30'N$) extending to the coastal zone of Belgium and the Netherlands but apparently being absent in the shallow offshore area of Britain. Here nematode numbers are relatively low, but high densities for copepods were recorded; the median grain size of the sediment averages 250-300 µm. The copepod community is dominated by mesopsammic harpacticoids mainly belonging to the families Paramesochridae, Cylindropsyllidae and Ectinosomatidae and by various interstitial cyclopoids. The Southern Bight community is unique for the entire North Sea; only a few localities along the western coast of Denmark and around the Isle of Sylt give indication of a similar composition, however, these data reflect only local situations and not a phenomenon on a larger scale.

Despite the presence of coarse sediments Paramesochridae/Cylindropsyllidae are not typical for the German Bight and the west coast of Denmark. Particularly in the very coarse sediments in the entrance to the Skagerrak, these families seem to be outnumbered by Ameiridae and Canthocamptidae.

In the Belgian and Dutch coastal zone of the Southern Bight, 4 cyclopoid and 70 harpacticoid species were found. The latter belong to 7 families: Paramesochridae (24), Cylindropsyllidae (21), Ameiridae (10), Ectinosomatidae (6), Diosaccidae (5), Tachidiidae (2) and Tetragonicipitidae (2). The resemblance between the harpiticoid associations from the Southern Bight and those of the coarse sands of the French Catalonian coast and the Irish Sea suggests that the copepod faunas of medium and coarse (> 300 µm) offshore deposits are similar, provided that the sands are well-sorted and clean.

The areas around the Dogger Bank and Devil's Hole are very impoverished; nearly all stations are characterized by a very fine sand with often a high amount of mud. Copepod numbers are generally much lower and mesopsammic species are nearly absent. Characteristic species are representatives of the Cletodidae, Longipediidae and large burrowing Ectinosomatidae. This large area is also defined by the absence of Priapulida and Kinorhyncha and very low numbers of tardigrades and gastrotrichs.

C.M.1990/Mini:9

Duineveld, G.C.A. and Noort, G.J. van (Netherlands Institute for Sea Research, P.O. Box 59, 1790 AB Den Burg, Texel, The Netherlands)

GEOGRAPHICAL VARIATION IN THE EPIFAUNA OF THE SOUTHERN NORTH SEA AND ADJACENT REGIONS

During the ICES "North Sea Benthos Survey" in 1986, the epifauna was sampled at 59 stations in the Dutch Sector of the North Sea by means of a 5.5 m beam trawl. The species composition and biomass at each station was determined. On the basis of the distribution and abundance of invertebrate species, four station groups were delimited which respectively cover the area north of Dogger Bank, the Dogger Bank proper, the Oyster Ground and part of the southern Bight. The major transition in species composition is situated along the northern edge of Dogger Bank. North of this border, the epifauna is numerically dominated by species not found at southern stations. The overall gradient in species composition seems to be orientated in a south-north direction, with the Dogger Bank taking an intermediate position. A relation between this gradient and sediment parameters or depth, as was previously reported for the epifauna of the northern North Sea, was not found.

The distribution of invertebrate biomass shows relatively high levels around Dogger Bank, in the southern part of the Oyster Ground and along the Dutch coast. Low biomass levels are concentrated in the central Oyster Ground and at the shallow parts of the Dogger Bank. Echinoderms (starfish, ophiuroids) are on average the most important contributors to the epifaunal biomass in the southern North Sea, but not at the stations north of Dogger Bank. The distribution pattern of epifaunal (invertebrate) biomass shows little similarity with the distribution pattern of infaunal biomass in the same area.

Beside the results from the Dutch Sector, a brief overview is given of the distribution of epifaunal assemblages in adjacent areas. A reliable analysis of the combined abundance data from these and the present study is inhibited by the fact that a wide variety of trawls and dredges, each with a different efficiency, were used. However, the apparent correpondence between the dominant species in overlapping areas suggests that it is worthwhile taking into account all separate results when planning new studies on epifaunal assemblages.

C.M.1990/Mini:10

Heip, C., Herman, P.M.J., Craeymeersch, J. and Soetaert, K.

STATISTICAL ANALYSIS AND TRENDS IN BIOMASS AND DIVERSITY OF NORTH SEA MACROFAUNA

Total biomass and biomass of large taxonomic groups (polychaetes, molluscs, crustaceans, echinoderms) and species diversity of the macrofauna were determined for 200 North Sea stations sampled synoptically by seven vessels during spring 1986 and for additional stations sampled in earlier years by the Marine Laboratory of MAAF in Aberdeen.

There exists a clear and significant decreasing trend in biomass with latitude, both in total biomass and for the different taxonomic groups. Apart from latitude also sediment composition and chlorophyll-a content of the sediment influence total biomass and biomass of most groups significantly. Biomass increases consistently in finer sediments and sediments with a higher chlorophyll-a content. The same trends are found for the results within laboratories. Some interaction exists, indicating weak laboratory and zonal effects.

Diversity, as measured by Hill's diversity index $N_1 = \exp H'$ shows a clear and significant trend with latitude. Towards the north of the North Sea diversity increases considerably. The trend is also found for laboratories separately and is everywhere equally strong. Environmental variables had not clear influence on diversity. Other diversity measures show the same trend but are more variable than N_1.

C.M.1990/Mini:11

Bergman, M.J.N., Fonds, M., Hup, M. and Stam, A. (Netherlands Institute for Sea Research, P.O. Box 59, 1790 AB Den Burg Texel, The Netherlands)

DIRECT EFFECTS OF BEAMTRAWL FISHING ON BENTHIC FAUNA

Direct effects of beamtrawling on benthic species in the North Sea were determined by comparing faunal abundances before and after commercial beamtrawling on hard-sandy sediments. Three-fold trawling resulted in a decrease in density (10-65%) of a number of species (echinoderms, polychaete worms and molluscs). Mortality of a number of species which were caught in the nets and treated on board the trawler, was estimated at 30 to 90%. Only the hermit crab Eupagurus bernardus and the starfish Asterias rubens have a good change (resp. 100% and 80%) to survive after returning in the sea again. Of the benthos escaping through the meshes the starfish, swimming crab and brittle star have a good change of almost 100% to survive. Direct effects of beamtrawling on the benthic fauna in the investigated area are clearly detectable, indicating that the structure of the benthic community in the area studied, which was intensively trawled in the past, already differs from a non-fished area.

Direct effects of beamtrawling on the densities of fish species in the studied area could not be detected by the methods used. Most fish caught in the trawl were dead or died soon after. During this experiment, the amount of dead discard fish was estimated at 2-4 times the amount of marketable fish. This cannot be extrapolated to other seasons or areas. Of the fish escaping through the net, depending on the species, 56% to 100% survived during this experiment.

The presence of benthic infauna in catches of the beamtrawl indicated that tickler chains and the ground chain most likely scaped off successive layers of sediment and reached at least 6 cm into the sediment. It is possible that this happened only in part of the trawled area.

Yvirlit yvir útkomin smárit frá Fiskirannsóknarstovuni.

Smáritini frá Fiskirannsóknarstovuni eru ætlað fyri part til innanhýsis nýtslu á stovninum at lýsa fyribils úrslit, sum ikki eru nóg fullfiggjað ella hava nóg miklan almennan áhuga til at koma í ritið: *Fiskirannsóknir*, og fyri part verða tey nýtt til at skjalprógva álit til myndugleikar ella smærri skrivlig avrik.

Í flestu førum verða smáritini send bløðunum til kunningar, og Landsbókasavnið fær tvítak av øllum ritum. Tey verða tó bert prentað í heilt fáum eintøkum, og Fiskirannsóknarstovan hevur vanliga ikki eintøk at lata einstaklingum ella stovnum. Loyvt er at margfalda og nýta innihaldið í ritunum.

Smárit 1989:

89/1 : Stovnsmetingar 1989

89/2 : Migrations of cetaceans and seals in the Northeast Atlantic in relation to hydrography (Samandráttur á enskum frá fundi, hildin í Norðurlandahúsinum 29/8-3/9 1988).

89/3 : Hummaraveiðan. *Árni Nicolajsen.*

89/4 : Hvussu nógv tola fiskastovnarnir. *Hjalti í Jákupsstovu.*

89/5 : Fiskaalingin í Føroyum fyrst í 90-árunum, alistøðir og framleiðsla. *Andrias Reinert.*

89/6 : Trolingin á landleiðini. *Rógvi Mouritsen og Hjalti í Jákupsstovu.*

89/7 : Algukanningar, 1989. *Eilif Gaard og Karina Nattestad.*

89/8 : Kanningar við Magnusi Heinasyni 1989.

Smárit 1990:

90/1 : Royndir við flatfiskagørnum. *Rógvi Mouritsen.*

90/2 : Stovnsmetingar 1990. *Andras Kristiansen.*

90/3 : Viðgerð av ársfundinum hjá ICES í 1990. *Jan Arge Jacobsen.*