Abstract— Lqqbo qo^tip ^ob sbov bccb`qfsb ^q `^mqrofkd ci^qcfpe) _rq qebv `^k ^ccb`q qeb pb^cillo b`lpvp* qbjp tebob qebv ^ob rpba+ >i^ph^ ci^qcfpe qo^tibop e^sb sbov ilkd `^_ibp %`^iiba ptbbmp& _bqtbbk allop ^ka kbq ql eboa cfpe fkql qeb m^qe lc qeb qo^ti+ Qebpb ptbbmp) tef`e ofab lk ^ka `^k afpqro_ qeb pb^cillo) ^``lrkq clo jlpq lc qeb ^ob^ ^ccb`qba _v qebpb qo^tip ^ka ebk`b ^i^odb mol* mloqflk lc qeb mlqbkqf^i clo a^j^db ql pb^cillo lod^kfpjp+ Tb bu^jfkba jlafcf`^qflkp ql lqqbo qo^tip) pr`e qe^q afph `irpqbop tbob fkpq^iiba ^q 6*j fkqbos^ip ql o^fpb qo^tiptbbmp pj^ii afpq^k`bp ^_lsb qeb pb^cillo) dob^qiv obar`fkd qeb ^ob^ lc afob`q pb^cillo `lkq^`q+ > `ofqf`^i `lkpfabo* ^qflk t^p tebqebo ci^qcfpe tlria pqfii _b eboaba bccb`qfsbiv _v qebpb ptbbmp+ Tb `ljm^oba `lksbkqflk^i ^ka jlaf* cfba ptbbmp rpfkd ^qtfk qo^tipvpqbj ^ka ^k^ivwba qeb sq ^fpba .- `j) ^ka Lqqbo qo^tipvpqbj obi^qfsbivpj^ii %2¬.- "&+ Kl pfwb `lj

*

mlpfqflk `e^kdbp tbob abqb`qba fk qeb ci^qcfpe `^q`ebp+ >i^ph^ mliil`h %*Theragra chalcogramma*& tbob `^mqroba ^q efdebo o^qbp tfqe qtl sbopflkp lc qeb jlafcfba ptbbmp+ Plk^ol_pbos^* qflkp lc qeb ptbbmp fk lmbo^qflk ^ka qeb pb^cillo ^cqbo m^pp^db `lkcfo jba qe^q qeb ^ob^ lc afob`q pb^cillo `lkq^`q t^p dob^qiv obar`ba _v qeb jlafcfba ptbbmp+

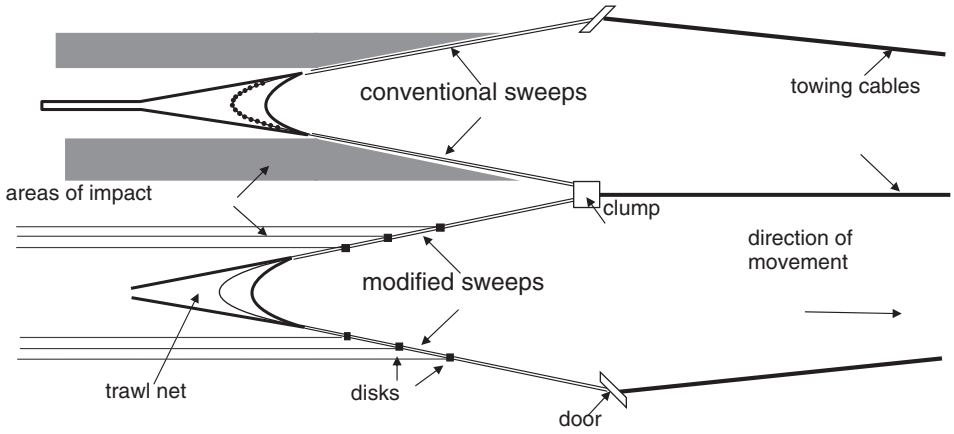
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bccb`qfsb jbqelap clo `^mqrofkd `ljbo`f^i nr^kqfqfbp lc «^qªpe ^ka fp qeb mofk`fm^i jbqela clo «^qªpe e^osbpq fk >i^ph^ t^qbop+ Eltbsbo) qo^ticfpebofbp e^sb ob`bfsba fk`ob^pfkd ^qqbkqflk clo qebfo mlqbkqf^i ql ^ccb`q pb^«llo e^_fq^qp+ @e^kdbp ql pb^«llo b`lpvpqbjp obpriqfkd colj qeb m^p* p^db lc qo^tidb^o e^sb _bbk e^sb abp`of_ba fk ^ tfab o^kdb lc pqrafbp %?^okbp ^ka Qeljp) /--2& Ilhhb* _lod) /--2&+ Qebpb fk`irab `e^kdbp ql fkc^rk^i %Qr`h bq ^i+) .665& ^ka bmfc^rk^i %H^fpbo bq ^i+) .665& Mobk^ bq ^i+) .666& J`@lkk^rdebv bq ^i+) /---& `ljjrkfqfbp) ^p tbii ^p fkaf* ob`q bccb`qp colj `e^kdbp ql pb^«llo pqor`qrob ^ka obprpmbkpflk lc pbaf* jbkqp %@ero`efii) .656&+ Qeb jlpq `ljjlk obpmlkpb ql jfqfd^qb qebpb mol_ibjp e^p _bbk `ilprobp lc pbk* pfqfsb ^ob^p ql qo^tifkd+ Tebk pr`e ^ob^p e^sb olrde) ol`hv pr_pqo^qbp) obdri^qflkp obnrfofkd qe^q qo^ticllq* olmb `olpp*pb`qflkp _b _bilt ^ `boq^fk pfwb e^sb _bbk rpba ql afp`lro^db cfpefkd fk qebpb ^ob^p& qeb pj^iibo cllqolmbp j^hb kbqp jlob srikbo^_ib ql a^j^db %E^kk^e) /--0& ?biij^k bq ^i+) /--2&+

>i^ph^k `ljjbo`f^i «^qªpe ªpebo* fbp) ^jlkd qeb i^odbpq fk qeb tloia) ^ob mroprba ^ijlpq bu`irpfsbiv tfqe abjbop^i lqqbo qo^tip+ %Qeb bu`bm* qflk kJ^krp`ofmq pr_jfqqba .3 G^kr^ov /--6+ J^krp`ofmq ^``bmqba .0 Klsbj_bo /--6+ Cfpe+ ?rii+ .-57.03¬.11 %/-.-&+

Qeb sfbtp ^ka lmfkflkp bumobppba lo bo^iiv rpb sbov ilkd `^_ibp) ebobfk `^iiba ¦ptbbmp)´ qe^q phfj qeb pb^* «llo ^eb^a ^ka ql _lqe pfabp lc qeb qo^tikbq+ Fk >i^ph^ «^qªpe ªpebo* fbp) qeb ªpebojbk e^sb rpba moldobp* pfsbiv ilkdbo ptbbmp ql fk`ob^pb qeb tfaqe lc qebfo db^o ^ka) ebk`b) qeb ^ob^ colj tef`e «^qªpe ^ob `^mqroba+ Qebpb ptbbmp klt ^``lrkq clo qeb lsbotebijfkd j^glofqv lc qeb pb^«llo ^ob^ ptbmq _v qebpb qo^tibop ql `^m* qrob «^qªpe+ >iqelrde qebpb ptbbmp dob^qiv fk`ob^pb «^qªpe `^q`ebp) qebv ^ipl ^``lrkq clo jlpq lc qeb kbd^qfsb bccb`qp lc qo^tifkd lk qeb pb^«llo+

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conventional sweeps
towing cables
areas of impact
clump
direction of
movement
modified sweeps
trawl net
disks
door

^ka ^ool t ql lqe cil r kabo %

A



Figure 2

P`eb j ^qf` af^do^ j lc ^ `irpqbo lc afphp %afph `irpqbo& ^qq^`eba ql qo^ t i p t bbmp ql o^fpb qeb p t bbmp ^_lsb qeb pb^cillo ql qbpq t ebqebo qefp db^o j lafcf`^qflk obar`bp ci^qcfpe eboafkd+ Or__bo afphp %**A**) /- ` j *af^ j bqbo) ^ka **B**) .2 ` j *af^ j bqbo& t bob fkpq^iiba lsbo qeb p t bbm `^_ib) _bq t bbk `i^ j mp %**D**& qe^q cfu qebfo il`^qflk lk qeb `^_ib+ Pqbbi t ^pebop %**C**& mobsbkqba or__bo afphp col j m^ppfkd lsbo `i^ j mp+ Olmbp pbfwba lsbo ^ka qr`hba qeolrde `^_ib %**E**& _il`hba `i^ j mp col j pefcqfkd+

«llo `lkq^`q+ Qefp t^p j lrkqba fk ^ molqb`qfsb piba) t ef`e t^p ql tba _lqe _befka qeb p t bbmp) ql pel t fkqbo^`qflkp _bq t bbk qeb p t bbmp ^ka qeb pb^cillo) ^ka) pbm^o^qb col j qeb qo^ t i) ^`olpp qeb qo^`h lc ^ mobsflrp e^ri) ql pel t j ^ohp ibcq lk qeb pb^«llo+ Qebpb l_pbos^qflkp t bob j ^ab lkiv lk p t bbmp t fqe qeb /-*` j afphp+ Qeb piba t^p ^ipl ql tba ^`olpp qo^`hp col j mobsflrp qo^ t i)

qb`qba fk [illegible]ro bumbof j bkq+ M^`fª` `la `^q`ebp af[illegible] klq `e^kdb pfdkfcf`^kqiv tfqe ^kv l[illegible]qeb j lafª`^qflkp+

Clo bs^[illegible]r^qfkd qeb ifhbifella lc pr_pq^kqf^[illegible] ilppbp lc `^q`e) qeb `lkª* abk`b fkqbo[illegible]s^ip molsfab j lob fkclo j ^* qflk qe^k [illegible]eb _^pf` pfdkfª`^k`b qbpqp ^ilkb+ Clo[illegible]bu^ j mib) qeb il t bo `lkcf* abk`b _lr[illegible]ap clo qeb bccb`qp lc /-*` j afphp lk «[illegible]qªpe `^q`ebp ib^sb lkiv ^ /+2" %. lc[illegible]1-& mol_^_fifqv qe^q `^q`e ilppbp t lr[illegible]bu`bba 1¬3"+@loobpmlka* fkd ¦t lopq[illegible]^pb´ ilppbp clo qeb .2*` j afphp t bob[illegible]osbk p j ^iibo+ Pf j fi^oiv) ^i* qelrde kl[illegible]b lc qeb M^`fcf` `la `^q`e obpriqp m^[illegible]ba qeb qeobpelia lc ^ 62" q t l*q^fiba[illegible]ol_^_fifqv lc _bfkd afccbo* bkq col j [illegible]`e^kdb) ^ii qeobb lc qeb `lkªabk`b[illegible]fkqbos^ip t bob ^i j lpq bk* qfobiv ^_ls[illegible]^ s^irb lc .+ Qebobclob) ^ qo^t ibo `l[illegible]ia f j mib j bkq lkb lc qebpb j lafª`^qfl[illegible]p t fqe ifqqib bumb`q^qflk lc `^q`efkd c[illegible]t bo M^`fª` `la ^ka t fqe ^ ob^plk^_ib[illegible]`e^k`b lc pifdeq fk`ob^pbp fk M^`fª`[illegible]a `^q`e+

Qeb pfwb[illegible]`l j mlpfqflk lc b^`e pmb* `fbp col j [illegible]b rk j lafªba kbqp %Cfd+ 3& pel t ba qo[illegible]k`^qflk ^q qeb il t bo bka lc qeb pfwb a[illegible]qof_rqflk) l t fkd ql rpb lc

Figure 6

Pfwb `l j mlpfqflkp clo ci^qcfpe ^ka d^afa pmb`fbp q^hbk arofkd qbpqp lc t ebqebo o^fpba q po

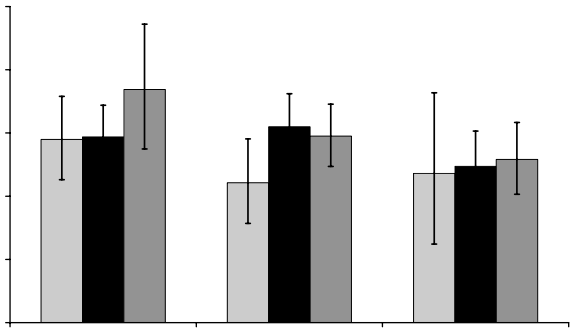


Figure 7

Bpqf j ^qbp lc ^ka 62" `lkcfabk`b fkqbos^ip clo o^qflp lc cfpe `^q`ebp arofkd qbpqp tfqe j lafcfba qo^ti p t bbmp o^fpba ql qeobb afccbobkq ebfdeqp lcc lc qeb pb^cillo ql `^q`ebp tfqe `lksbkqflk^i p t bbmp clo _ol^a pfwb `i^ppbp lc cl r o mofk`fm^i ci^q* cfpe pmb`fbp ^ka ^ mofk`fm^i d^afa pmb`fbp q^hbk fk ?bofkd Pb^ qo^ t i cfpebofbp7 vbiil t cfk plib %*Limanda aspera*&8 kloqebok ol`h plib %*Lepidopsetta polyxystra*&8 ci^qeb^a plib %*Hippoglossoides elassodon*&8 ^ool t qllqe cil r kabo %*Atheresthes stomias*&8 ^ka >i^ph^ mliil`h %*Theragra chalcogramma*&+

qelrde ifdeq ibsbip ^ccb`q qeb eboafkd mol`bpp %Ovbo ^ka ?^okbqq) /--3&+ Qeb bccb`qp lc ifdeq lk «^qªpe eboafkd ^ob ^k^ivwba ^ka obmloqba fk ^ pbm^o^qb m^mbo %Ovbo bq ^i+) /-.-&+

>iqelrde klq qeb cl`rp lc qefp pqrav) ^k rkbumb`qba obpriq t^p qeb fk`ob^pb fk mliil`h `^q`ebp qe^q l``rooba tfqe qtl lc qeb ptbbm j lafª`^qflkp+ Mliil`h eboa afccbo* bkqiv col j «^qªpe) ob^`qfkd ql pqf j rif ^q j r`e dob^qbo afpq^k`bp %Olpb) .663&+ Qeb clot^oa pb`qflkp lc qeb j lpq j labok mliil`h qo^tip e^sb ¦ j bpebp´ qe^q ^ob j lob qe^k /2*j ilkd+ >iqelrde i^odb dolrmp lc mli* il`h `lria b^pfiv ptf j qeolrde pr`e j bpebp) qebv pqfii ^slfa qeb kbqqfkd ^ka ^ob bsbkqr^iiv eboaba fkql m^oqp lc qeb kbq qe^q mevpf`^iiv obpqo^fk qeb j+ Qebpb kbqp tlria klq tloh fc mliil`h eboaba lkiv ^q peloq o^kdbp+ Pbm^o^qflk lc qeb ptbbmp col j qeb pb^«llo) lo qeb afph `irpqbop qeb j pbisbp) `lria e^sb fk`ob^pba sfpf_fifqv lc qeb ptbbmp) tef`e j ^v e^sb bke^k`ba mliil`h eboafkd+ ?lqe c^`qlop tlria _b obar`ba ^q qeb pj ^iibpq afphp) tebob eboafkd f j molsb j bkq t^p klq abqb`qba+

Plk^o l_pbos^qflkp lc qeb bibs^qba ptbbmp pel tba qe^q qebfo fkqbo^`qflk tfqe qeb pb^«llo t^p o^af`^iiv `e^kdba+ Qeb `lkqfkrlrp pbaf j bkq `ilrap molar`ba ^ilkd qeb bkqfob ibkdqe lc qeb rk j lafªba ptbbmp tbob) clo qeb j lafªba ptbbmp) obar`ba ql fpli^qba `ilrap _b* efka b^`e afph) fkaf`^qfkd pr_pq^kqf^i obar`qflkp fk qeb ^ob^ lc afob`q `lkq^`q+ Qebobclob) ^kv bccb`qp _^pba lk afob`q `lkq^`q) ^p tbii ^p obprpmbkpflk lc pbaf j bkqp)

^ipl `l j mif`^qb abmilv j bkq ^ka obqofbs^i _b`^rpb qebv
al klq t o^m ^p bsbkiv lkql obbip ^p r k j laf^{a}ba p t bbmp+