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Yield Estimates for Short-finned Squid (*Illex illecebrosus*) in SA 3-4 From Research Vessel Survey Relative Biomass Indices

by

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Only limited data are available for evaluating the status and yield potential of the northern short-finned squid, *Illex illecebrosus*, in the northwest Atlantic Ocean (Dawe and Hendrickson 1998). For the portion of the *Illex* stock in NAFO Subareas 3 and 4, information on abundance is limited to commercial landings and size composition data (Beck et al. 1998), and to relative stock size indices (i.e., mean catch per tow values) from July bottom trawl surveys conducted annually (1970-1997) on the Scotian Shelf (SA 4). The two sets of data both indicate that 1976-1981 was a period of high *Illex* productivity. During these six years, SA 3-4 landings averaged 80,645 tons/year [peaking at 162,092 tons in 1979], while the SA 4 survey relative biomass index averaged 12.63 kg/tow [peaking at 42.7 kg/tow in 1976] (Table 1). Since 1983, however, *Illex* productivity has been low. During 1983-1997, annual landings of *Illex* from SA 3-4 averaged only 4,079 tons [with a peak of 15,485 tons in 1997], while SA 4 survey biomass indices averaged just 2.94 kg/tow [with a peak of 7.3 kg/tow in 1992].

Estimates of relative fishing mortality for *Illex* in SA 3-4 can be derived by dividing the annual landings in SA 3-4 in each year by the SA 4 survey kg/tow index in that same year. As *Illex* do not normally become available to the SA 3-4 fisheries until late-July or August (Dawe and Hendrickson 1998), the July research vessel survey indices are assumed to reflect relative biomass at the start of the fishing season.

Relative fishing mortality rates for *Illex* in SA 3-4 peaked during the late 1970s-early 1980s (Table 1; Figure 1). During 1976-1981, relative F values increased from 0.10 to 4.09 and averaged 1.76 for the six-year period. After 1982, relative Fs have been very much lower, ranging between 0.02 and 0.97, and averaging 0.17.

To estimate the levels of potential yield that *Illex* in SA 3-4 might be able to sustain under the present low productivity regime, catches taken during the high productivity period can be adjusted by the ratio of the survey relative biomass indices between the two periods. This method does not assume any underlying stock dynamics and is considered more appropriate than production model analyses for the SA 3-4 *Illex* resource , given the potential influence of environmental variability on the availability of squid in this region (Dawe and Hendrickson 1998). As noted earlier, during the 1976-1981 high productivity period, SA 3-4 landings averaged 80,645 tons; during this time, the survey biomass index averaged 12.63 kg/tow. Since 1983, the survey index has averaged 2.94 kg/tow. Thus, one estimate of current potential yield from the SA 3-4 *Illex* resource is:

$$80{,}645 * (2.94/12.63) = 18{,}772 \text{ tons.}$$

Another estimate - using landings and survey data from just the peak year of catch (1979) - is:

$$162{,}092 * (2.94/14.2) = 33{,}560 \text{ tons.}$$

Implicit in these derivations is that the relative fishing mortality rates observed in the earlier high productivity period are appropriate during the current period. Mathematically, the current survey indices are simply being scaled by the relative fishing mortality rates (multiplied by 10,000 for scaling), viz:

$$(80{,}645/12.63) = \text{relative F} * 2.94 \text{ (survey index)} = 18{,}772 \text{ tons}$$

$$(162{,}092/14.2) = \text{relative F} * 2.94 \text{ (survey index)} = 33{,}560 \text{ tons}$$

Given that the relative fishing mortality rates during 1976-1981 were the highest on record (and that survey indices markedly declined in the years immediately following the elevated catches), the estimates of potential yield might best be considered as maximum values - or catch limit reference points.

References

Beck, P.C., E.G. Dawe, and J. Drew. 1998. An update of the fishery for short-finned squid (*Illex illecebrosus*) in the Newfoundland area during 1994-97 with descriptions of some biological characteristics. NAFO SCR Soc. 98/55, Ser. No. N3046, 16 p.

Dawe, E.G., and L.C. Hendrickson. 1998. A review of the biology, population dynamics, and exploitation of short-finned squid in the Northwest Atlantic Ocean, in relation to assessment and management of the resource. NAFO SCR Doc. 98/59, Ser. No. N3051, 33 p.

Table 1. Data summary for *Illex illecebrosus* in NAFO Subarea 3 and 4. Annual landings and research vessel indices are from SCR98/59. Relative F (fishing mortality) is the ratio of landings to survey index, divided by 10,000 to scale the values.

Year	Landings (tons)	SA 4 Survey Index (kg/tow)	Relative F
1970	1385	0.4	0.35
1971	8906	2.8	0.32
1972	1868	0.7	0.27
1973	9877	1.5	0.66
1974	437	1.8	0.02
1975	17696	5.0	0.35
1976	41767	42.7	0.10
1977	83480	9.5	0.88
1978	94064	2.3	4.09
1979	162092	14.2	1.14
1980	69606	2.2	3.16
1981	32862	4.9	0.67
1982	12908	2.1	0.61
1983	426	2.1	0.02
1984	715	1.5	0.05
1985	673	2.7	0.02
1986	111	0.4	0.03
1987	566	0.4	0.14
1988	800	2.7	0.03
1989	7000	2.7	0.26
1990	11000	4.8	0.23
1991	3996	1.8	0.22
1992	2000	7.3	0.03
1993	2674	5.4	0.05
1994	5970	4.2	0.14
1995	1032	2.4	0.04
1996	8730	0.9	0.97
1997	15485	4.8	0.32
Mean 1970-1997	21362	4.79	0.54
1976-1981	80645	12.63	1.67
1983-1997	4079	2.94	0.17
Maximum	162092	42.7	4.09
Minimum	111	0.40	0.02

Fig. 1 Relative Fishing Mortality Rate of *Illex* squid in SA 3-4, 1970 - 1997