



ASSESSMENT OF AMERICAN PLAICE IN THE SOUTHERN GULF OF ST. LAWRENCE (NAFO DIV. 4T) IN 2007

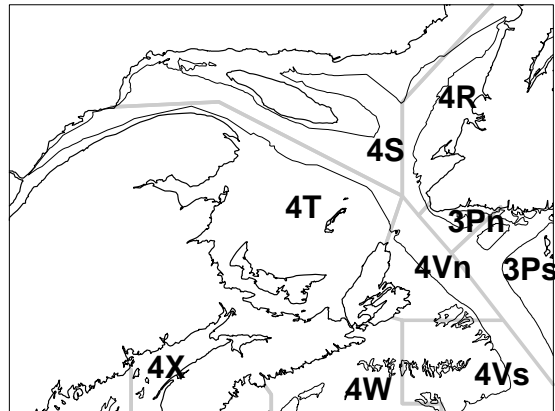


Figure 1: The Gulf of St. Lawrence and adjacent areas, showing NAFO divisions.

Context

American plaice in the southern Gulf of St. Lawrence (NAFO Division 4T) was exploited mainly by longlines in the 1930s, but by the 1960s most landings were made by seines and otter trawls. Plaice are now caught by mobile gear, with the dominant sector being seines operated by vessels less than 45 feet. With the growth of mobile gear sectors during the 1960s, a large component of plaice catches in 4T (30-40% by weight) was commercially-undersized and discarded at sea. From the mid-1960s and throughout the 1970s, landings fluctuated around 9,000 t, reaching their highest level in 1976 at over 11,000 t. Landings declined sharply in the 1990s and have reached their lowest level in recent years (339 t in 2005; 369 t in 2007).

Southern Gulf American plaice has been under quota management since 1977. A TAC of 10,000 t was maintained until 1992 despite concern that the stock was undergoing a decline in abundance through the 1980s. It was felt at the time that more restrictive quotas would only incite increases in at-sea discarding of plaice. The TAC on plaice was dropped to 5,000 t in 1993 following the closure of the 4T cod fishery in order to protect plaice from a redirection of fishing effort from cod to other groundfish stocks. Several reductions of the TAC have followed since 1993; the current TAC of 750 t has been in effect since 2003. Several management measures have been introduced since 1993 to reduce the incidence of discarding in the 4T plaice fishery. These measures include increased mesh sizes, mandatory landing of all catches, at-sea observer coverage and dockside monitoring. The stock has been assessed regularly since 1978; however, the last full assessment was conducted in February 2001.

SUMMARY

- Landings were 369 t in 2007 and have been at historical lows for this stock for several years (less than 1,000 t since 2002). Fishing effort has declined to very low levels in recent years.
- Key indicators for the stock, including the survey index of abundance and recruitment estimates, are near the lowest values ever observed.
- The growth of adults has been low since the early 1980s.
- Total mortality has averaged 0.54 since 1992 and remains near the long-term average since 1971 despite recent declines in fishing effort.
- Natural mortality is estimated to be very high, accounting for almost all of the total mortality.
- The spawning stock biomass is low and projected to decline by 2.4% in the absence of fishing.
- Prospects for rebuilding this stock are poor under current conditions. Rebuilding will require an increase in productivity and minimum harvests.

BACKGROUND

Biology of the species

American plaice (*Hippoglossoides platessoides*) are widely distributed throughout the Northwest Atlantic, from West Greenland to the Gulf of Maine. Throughout their range, their summer distribution is associated with intermediate depths (about 80-250 m) and cold waters (below 0°C to 1.5°C). Southern Gulf plaice move to deeper channel waters in the winter where they occupy warmer water, but cease feeding. Male and female plaice differ in their life-history traits: females grow faster and attain larger sizes than males; male plaice have shorter lives than females. Sexual maturity is reached at 7-15 years of age for females and between 5 and 7 years of age for males. Spawning occurs from early spring to summer with each female releasing hundreds of thousands of eggs. The fertilized eggs float near the water surface for several days. After hatching, plaice are pelagic until they reach a minimum length of 18 mm, when metamorphosis occurs and they become benthic. Plaice consume a wide range of organisms throughout their life cycle: young plaice consume bottom organisms such as mysid shrimp, amphipods, polychaetes, echinoderms and molluscs; older plaice consume other small fish species and invertebrates.

Fishery

An annual TAC of 750 t has been in effect since 2003. In 2007, **landings** totaled 369 t, the second lowest landed catch in data recorded since 1965. The lowest catch of 339 t was recorded in 2005 (Table 1, Figure 2). For the past four decades, the resource has been exploited mainly by mobile gears: stern trawlers and Danish and Scottish seiners. The decline in landings has been associated with a proportionate decline in **fishing effort**, measured by the number of days spent fishing, recorded in vessel logbooks since 1991 (Figure 3). In 2007, 15 seiners and 13 trawlers directed their fishing effort at 4T American plaice, with a combined total

of 116 days of plaice-directed fishing. In contrast, during the early 1990s over 250 vessels directed yearly for plaice in 4T over more than a thousand days of fishing.

Table 1: Landings and TAC of American plaice in the southern Gulf of St. Lawrence.

Year	Average 1981-1990	Average 1991-2000	Average 2001-2003	2004	2005	2006	2007 ¹
TAC	10,000	4,500	1,250	750	750	750	750
Landings	7,264	2,434	753	400	339	474	369

¹ preliminary data

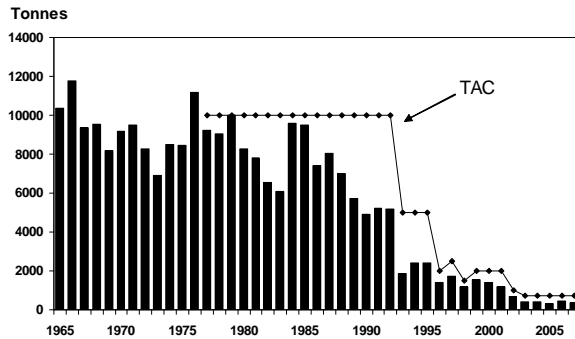


Figure 2. Landings and TAC (t) of American plaice in the southern Gulf of St. Lawrence.

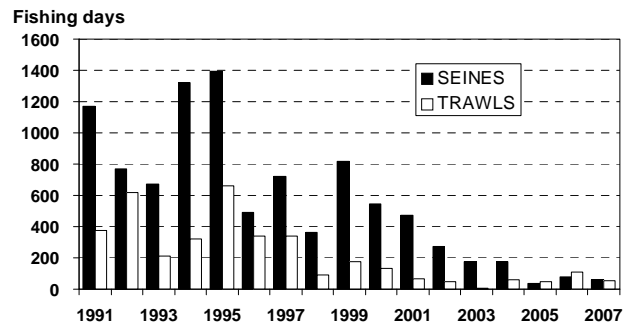


Figure 3. Fishing effort by trawlers and seiners directing for American plaice in the southern Gulf.

The management plan for 4T plaice allocates approximately 40% of the TAC to the competitive fleet of vessels less than 45 feet in length that fish with mobile gear. This is the only fleet that yearly attains its allocated catch of American plaice. With the closure of the 4T cod fishery in 1993, several management measures were adopted to conserve other groundfish fisheries such as American plaice. The plaice TAC was reduced by half in 1993 to prevent a redirection of fishing effort from cod to plaice and measures were introduced to stop the practice of at-sea discarding that was prevalent in the 4T plaice fishery. These measures continue in the present 4T plaice fishery, including the mandatory landing of all catches, a minimum legal size of 30 cm, increased mesh size, increased observer coverage at sea, and dockside monitoring of all plaice catches.

Since 1976, the size and age composition of commercial catches is determined through port sampling of landed catches and at-sea sampling by observers. The 1970 and 1973 year-classes appeared as modes in four successive years during the 1980s; however, more recent commercial catches do not show strong recruiting year-classes. Despite the increase in mesh sizes since 1993, the proportion of the catch less than the legal size of 30 cm has increased due to the mandatory landing of all catches (Figure 4).

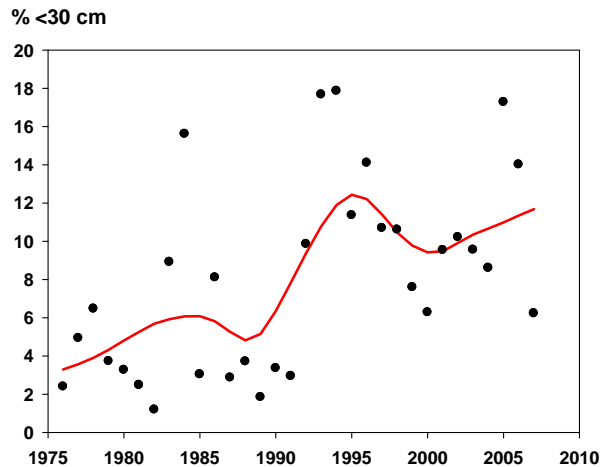


Figure 4. The percentage of small American plaice (<30 cm) landed in the southern Gulf.

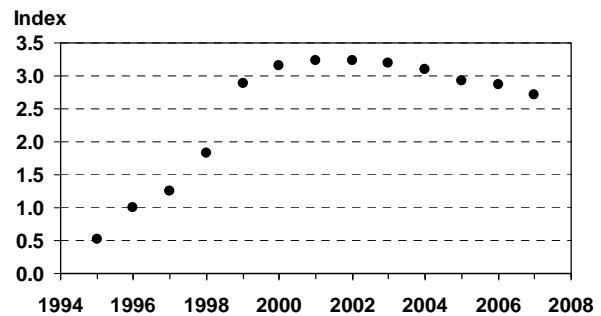


Figure 5. Index of opinions on abundance of American plaice based on a telephone survey of fish harvesters.

A **telephone survey** has been conducted yearly since 1995 to obtain the views of active harvesters on conditions in the fishery and the abundance of groundfish stocks. For several years, the decline in fishing effort in the 4T plaice fishery has been attributed by harvesters to unfavorable market conditions, mainly low price and weak market demand. When asked in the telephone survey to judge the abundance of plaice compared to the previous year's fishery, harvesters tended to respond favorably during the 1990s (i.e. judging that plaice were more abundant than in the previous year). The trend in opinions on the abundance of 4T plaice relative to the previous year is shown by a cumulative average score attributed to these responses (Figure 5). It shows that the positive view of plaice abundance that was expressed in the late 1990s has declined somewhat and harvesters tend to view 4T plaice abundance as similar to that of the previous year. These opinions are sought from harvesters who fished plaice as their first or second preferred species. Of the 193 harvesters interviewed in 2007, only seven identified plaice as their first or second preference, the lowest participation of plaice harvesters in the telephone survey to date.

ASSESSMENT

Stock trends and current status

Trends in the abundance of 4T American plaice are determined through **research vessel (RV) surveys** conducted yearly throughout the southern Gulf every September since 1971. These surveys are conducted with the same vessel, gear and fishing procedures from year to year. Whenever the fishing vessel or gear was changed, experimental fishing was conducted with the two vessels fishing side-by-side to establish conversion factors of the fishing efficiency of the vessels or gears. An exception to this occurred in 2003 when the CCGS *Alfred Needler* was disabled and replaced by the CCGS *Wilfred Templeman*. No conversion factor was determined for these two vessels and the survey was not completed. As a result, we do not include the 2003 survey in our assessment of abundance trends for 4T American plaice.

The RV survey index increased rapidly to peak biomass in 1976, but declined in the early 1980s (Figure 6). Except for an increase in 1990 and 1991, total **stock biomass** has continued to decline to a minimum level in 2002 and 2004. The index of exploitable biomass of plaice 30 cm

and larger reached its lowest level at 5 kg per tow over the past five surveys. Periods of high abundance corresponded to strong recruiting year-classes, particularly of plaice born between 1970 and 1974 (Figure 7). **Year-class abundance** since 1990 has been consistently low relative to year-classes as far back as the late 1960s.

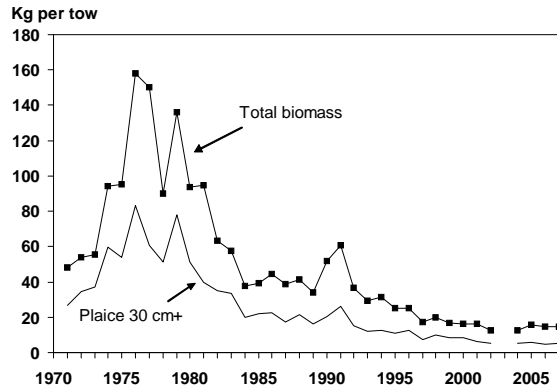


Figure 6. Research survey index of stock biomass (all sizes) and exploitable biomass (30 cm and greater).

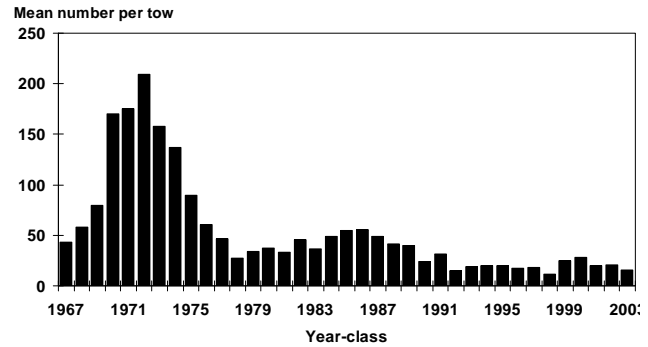


Figure 7. Year-class index of abundance at 5 years of age.

The size and age composition of the RV survey plaice catches peaks between 20 and 40 cm and ages 4 to 6. The size distribution of catches has shifted to smaller sizes over time. This partly reflects a contraction of the size distribution through the loss of large fish from the stock. The mean size at age of plaice declined in the late 1970s and early 1980s and has failed to improve since then (Figure 8). The size increment between age classes is currently much smaller than it was in the 1970s, indicative of slower growth rates.

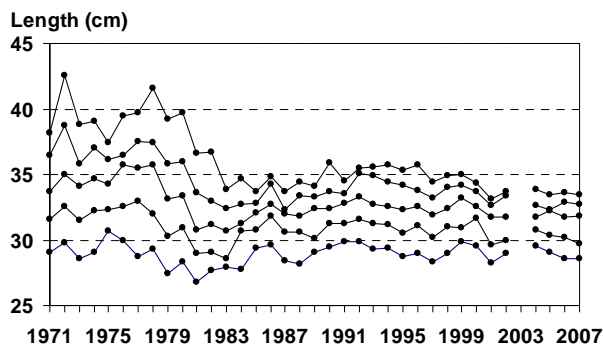


Figure 8. Mean length of female plaice of ages 7-11 in research surveys of the southern Gulf.

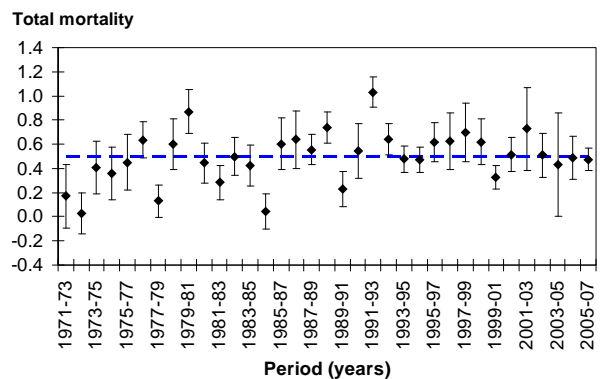


Figure 9. Total mortality of 4T plaice in 3-year periods between 8 and 20 years-of-age, based on research survey data. The horizontal line indicates the long-term average mortality (0.50).

Total mortality (Z) was estimated from the survey catch-at-age. Despite declining effort in the 4T plaice fishery, Z remains close to the long-term average of 0.5 (Figure 9). Based on these estimates, Z has averaged 0.54 since 1992, following the closure of the cod fishery and the reduction in plaice catches.

The RV survey provides information on the **distribution** of American plaice in 4T over time. When the plaice stock was abundant in the southern Gulf, during the late 1970s, there were

high densities of plaice throughout the western part of 4T, on the Magdalen Shallows, in Chaleur Bay and off the Gaspé coast. As may be seen from the distribution map of the 2007 survey (Figure 10), plaice are now concentrated off the western shore of Cape Breton, north and east of Prince Edward Island, and off Miscou. This is consistent with the recent geographic distribution of the plaice fishery which has become increasingly concentrated in eastern 4T.

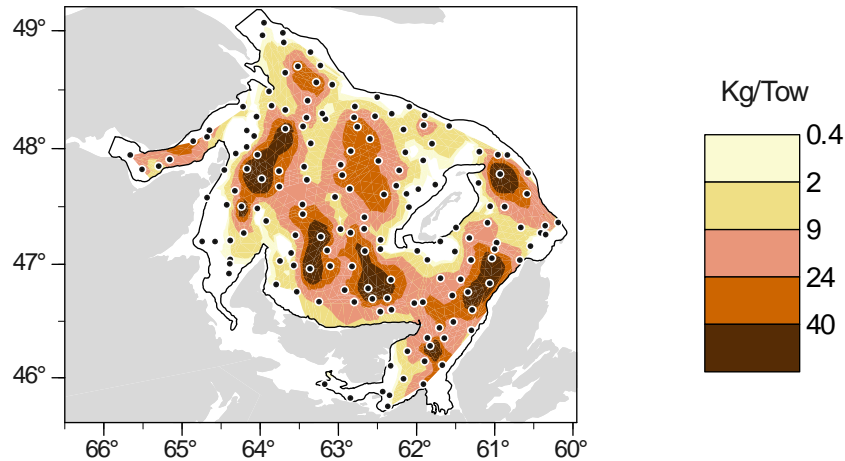


Figure 10. Distribution of plaice catches in the 2007 research vessel trawl survey.

The **sentinel program** began in 1994 with the objective of tracking abundance trends of Atlantic cod using commercial vessels. In 2003, a sentinel trawl survey was started using a 300 Star Balloon otter trawl with a 40-mm codend liner and with a similar sampling design and protocols to the annual RV survey. The sentinel trawl survey is conducted every August and participating vessels are deployed to all areas to allow overlap in coverage and the calculation of coefficients of relative fishing efficiency. American plaice is caught in the majority of tows conducted in the sentinel trawl survey and exhibits a similar distribution to plaice captured in the annual RV September survey (Figure 11). Plaice catches in the sentinel program dropped after 2004 and continue to decline moderately in number and biomass (Figure 12).

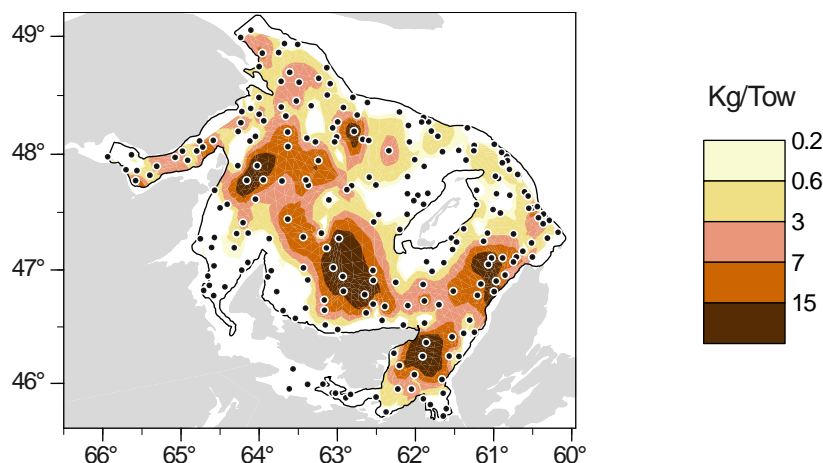


Figure 11. Distribution of plaice catches in the 2007 sentinel trawl survey.

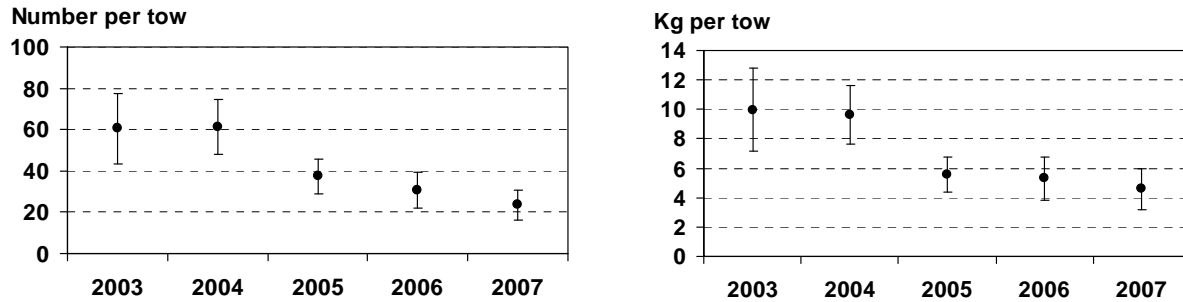


Figure 12. Sentinel indices of plaice abundance and biomass, with approximate 95% confidence limits.

A population model was used to estimate the biomass of 4T American plaice, spawning stock biomass (SSB), natural mortality, and fishing mortality. The last 15 years of the fishery, from 1993 to 2007, were used in the model as these years provide more reliable estimates of the commercial catch-at-age without significant discarding of small fish. The stock biomass (ages 4+) was estimated to be 61,800 t in 2008, near the lowest estimated value (61,600 t in 2002). The SSB was estimated to be about 38,000 t in 2008, slightly above its lowest level (32,000 t in 2001) (Figure 13). Natural mortality on plaice since 1993 was high, estimated at 0.55, accounting for most of the total mortality. Rates of exploitation declined from about 3% in 1994 to about 1% since 2003 (Figure 14).

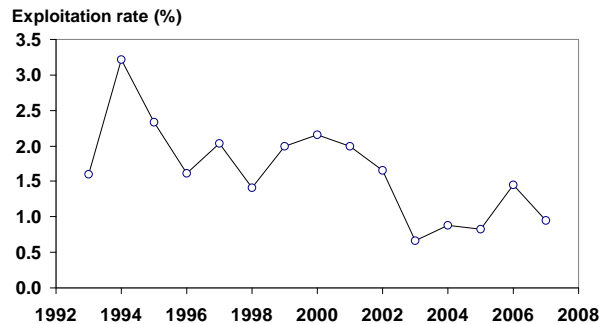
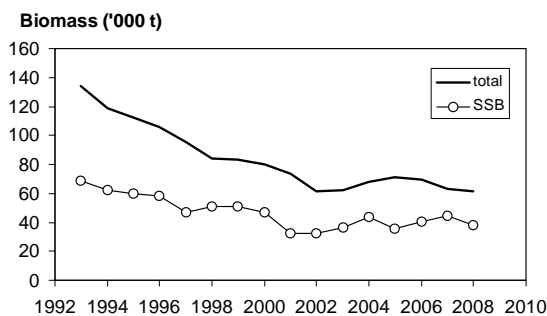


Figure 13. Population model estimates of total biomass and spawning stock biomass (SSB) of 4T American plaice.

Figure 14. Exploitation rate (ages 8 to 20) of southern Gulf American plaice.

Sources of uncertainty

The practice of discarding commercially undersized plaice at sea was very prevalent in the 4T fishery, causing uncertainties in the age composition of plaice catches. This uncertainty prevents us from obtaining a long-term view of the stock dynamics. Because of this problem, the population model is restricted to the past 15 years, a period in which several management measures have been established to prevent discarding. Any ongoing discarding or misreporting of commercial catches would confound the estimation of natural mortality in the 4T plaice stock.

The high level of natural mortality in the 4T American plaice stock cannot be firmly attributed to any known cause. The population of grey seals in the southern Gulf is high and it is widely felt by harvesters that seal predation is a contributing factor in the lack of recovery of several groundfish stocks in the southern Gulf. While seal diet studies confirm their consumption of

plaice, presently there is no firm evidence that seal predation can account for the high level of natural mortality in the 4T plaice stock.

CONCLUSIONS AND ADVICE

In spite of recent low harvest levels on 4T American plaice, declining fishing effort on the stock and a number of progressive management measures, several key indicators suggest that the stock is failing to rebuild. The research survey index over the past five years shows that stock biomass is at its lowest level since the survey began in 1971. The sentinel trawl survey covers only the past five years, but shows a declining trend for the stock. There is no evidence of strong incoming recruitment of year-classes in data obtained from the commercial fishery and the research surveys. The size distribution of plaice in the research survey data has shifted to smaller sizes and also contracted through the loss of larger, older plaice from the population. The size-at-age and growth rates of 4T plaice have declined since the 1970s and show no sign of improvement. Total mortality on the stock since 1992 has been somewhat higher than the long-term average. Natural mortality on the stock is high and accounts for most of the total mortality.

There are no reference points defined for 4T American plaice. Harvest control rules consistent with the precautionary approach have also not been defined.

Projections were made of the 4T plaice stock to 2009, under a range of harvest levels from 0 to 2,000 t (Figure 15). These indicate that the spawning stock biomass is expected to decline in 2008 by about 2.4% without any fishery. Under current stock conditions, with high natural mortality and low rates of exploitation, a harvest level similar to that of 2007 (at 400 t) would cause a marginal increase in the loss of spawning stock biomass of less than 1%. Given the low productivity of this stock and its current level of abundance, the prospects for improvement in the abundance of this stock are poor in the short term.

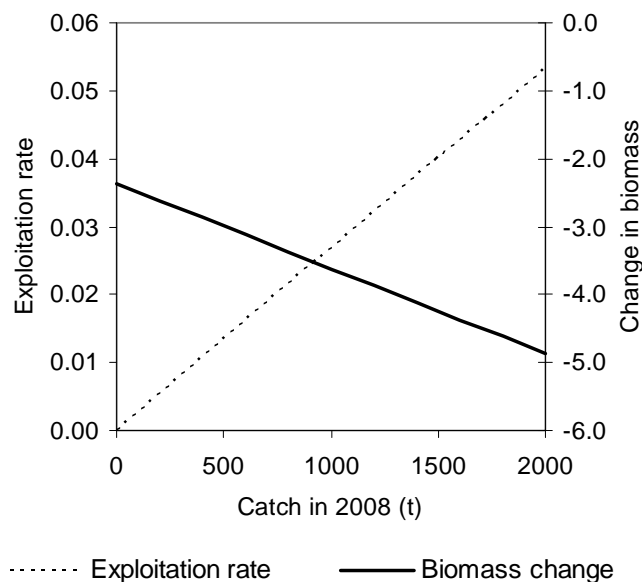


Figure 15. Projected results of harvest levels in 2008.

SOURCES OF INFORMATION

Morin, R., S.G. LeBlanc, G.A. Chouinard and D. Swain. 2008. Status of NAFO Division 4T American plaice, February 2008. DFO Can. Sci. Advis. Sec. Res. Doc. (in prep.).

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ISSN 1480-4913 (Printed)
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CORRECT CITATION FOR THIS PUBLICATION

DFO. 2008. Assessment of American plaice in the southern Gulf of St. Lawrence (NAFO Div. 4T) in 2007. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2008/005.