

THE WESTERN ATLANTIC BLUEFIN TUNA TRAPNET FISHERY

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SUMMARY

Traps are not a fully developed technique for capturing bluefin tuna (BFT) in the U.S. fishery. However, during the first half of the 20th century, bluefin tuna were a common by-catch species in the Canadian mackerel (Scomber scombrus) trap fishery. Plans to 'ranch' early-season fish led to the first St. Margaret's Bay (SMB) tuna impoundments in 1937. After World War II, there was a domestic market for canned tuna, vitamins derived from tuna liver oil and pet food. The implementation of a mercury ban in 1970 limited the North American markets. The development of airline freight in 1973 opened Japan to Canadian-landed tuna. Japanese developed partnerships and "ranching" of fish in St. Margaret's Bay began in 1975. Bluefin tuna were harvested when Japanese market conditions were optimal. It is unlikely that the Canadian trap-net fishery can be used as an index of abundance as the St. Margaret's Bay trap catches are not considered proportional to West Atlantic bluefin tuna abundance, and the available data do not facilitate effort calculations. Nonetheless, important research has been facilitated by the availability of bluefin tuna from the trap fishery.

RÉSUMÉ

Les madragues ne constituent pas une technique très développée aux fins de la capture de thon rouge (BFT) dans la pêcherie des États-Unis. Toutefois, pendant la première moitié du 20^e siècle, le thon rouge constituait une espèce commune de prise accessoire dans la pêche à la madrague de maquereau bleu (Scomber scombrus) du Canada. Des plans visant à engraisser des poissons au début de la saison ont donné lieu aux premiers filets d'engraissement de thons de la baie de St Margaret en 1937. Après la deuxième guerre mondiale, il existait un marché national de thons mis en conserve, de vitamines provenant d'huile de foie de thon et d'aliments pour animaux domestiques. La mise en œuvre de l'interdiction du mercure en 1970 a limité les marchés de l'Amérique du Nord. Le développement du transport de fret aérien en 1973 a fait en sorte que le thon débarqué au Canada soit acheminé vers le Japon. L'année 1975 est marquée par le début des accords de partenariat avec le Japon et l'élevage de poissons dans la baie de St Margaret. Le thon rouge était mis à mort lorsque les conditions du marché au Japon étaient optimales. Il est peu probable que la pêche à la madrague du Canada puisse être utilisée en tant qu'indice d'abondance étant donné qu'il est estimé que les prises des madragues de la baie de St Margaret ne sont pas proportionnelles à l'abondance du thon rouge de l'Atlantique Ouest et que les données disponibles ne facilitent pas le calcul de l'effort. Néanmoins, d'importants travaux de recherche ont été facilités grâce à la disponibilité de thon rouge provenant de la pêche à la madrague.

RESUMEN

Las almadrabas no son una técnica muy desarrollada para capturar atún rojo (BFT) en la pesquería estadounidense. Sin embargo, durante la primera mitad del siglo XX, el atún rojo era una especie común de captura fortuita en la pesquería de almadrabas canadiense de caballa (Scomber scombrus). Los planes para engordar a los peces de la primera parte de la temporada condujeron a las primeras jaulas de engorde de la Bahía de Santa Margarita en 1937. Después de la Segunda Guerra mundial, existía un mercado nacional para el atún enlatado, y las vitaminas se derivaban del aceite de hígado de atún y la comida de mascotas. La implementación de una prohibición del mercurio en 1970 limitó los mercados del Norte de América. El desarrollo de una aerolínea de transporte de mercancías en 1973 abrió Japón al atún desembarcado en Canadá. Los japoneses desarrollaron asociaciones y en 1975 empezó el engorde de peces en la Bahía de Santa Margarita. El atún rojo se sacrificaba cuando las condiciones del mercado japonés eran óptimas. Es poco probable que la pesquería canadiense de almadrabas pueda utilizarse como índice de abundancia ya que las capturas de la

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almadraba de la bahía de Santa Margarita no se consideran proporcionales a la abundancia de atún rojo del Atlántico oeste y los datos disponibles no facilitan cálculos del esfuerzo. No obstante, la disponibilidad de atún rojo en la pesquería de almadras ha facilitado importantes investigaciones.

KEYWORDS

Bluefin, tuna fisheries, trap fishing

1. The United States trap fishery for western Atlantic bluefin tuna

The fishery for western Atlantic bluefin tuna (WBFT) in the United States has been small and does not have a significant history of targeted bluefin tuna, as there are in other areas, specifically in the eastern bluefin tuna and Japanese fisheries. The history of the U.S. fishery began with traps in the area of Provincetown, MA in the 1950s to 1980s and the target species were for squid and scup (M. Godfried, personal communication). The traps in Gloucester, MA were for mackerel. The catch of bluefin tuna was incidental and created a significant problem for the fishermen seeking the target species. The bluefin tuna followed the mackerel or other prey species into the traps. The traps were of a small mesh (about 30 mm) and the bluefin tuna would destroy the nets and thus release the mackerel or other fish or squid in the traps. The traps near Cape Ann, MA are on floats and cover surface to almost the bottom but with a round enclosure in the cod end of the trap and the trap elements are anchored (**Figure 1**). All the traps have that basic structure with local variations in design and structure depending upon whether the target species are different fishes or squid. The practice of holding bluefin tuna in an impoundment to feed and then market was not used in the United States.

The mackerel traps on Cape Ann, MA and Provincetown, MA commonly caught bluefin tuna in the 1960s through the early 1980s. Landings decreased in the late 1980s. When quotas were established, the bluefin tuna that were captured were initially classified in the US landings report as “Incidental Catch.” The current practice is to identify pound nets and fish weirs as Authorized Gear (NOAA, 2010a) and report the landings as “Trap” (NOAA, 2010b). It should be recognized that the trap system has not been a fully developed technique for capturing bluefin tuna in the U.S. fishery as has the highly developed ancestral trap technology has been utilized on the Atlantic coast of Europe and Morocco, within the Mediterranean Sea and the coasts of Japan.

2. The Canadian trap fishery for western Atlantic bluefin tuna

During the first half of the 20th century, bluefin tuna (*Thunnus thynnus*) were a common bycatch species in the Canadian mackerel trap fishery, which are structurally similar to the U.S traps (**Figure 2**). Despite a limited market and a low price, fishermen in St. Margaret’s Bay, Nova Scotia (**Figure 3**), still harvested the trapped tuna, often shipping them to Boston, MA via rail (Clay and Hurlbut, 1990). This practice continued to yield marginal profits until the 1930s, when the first plans to ranch early season tuna were proposed in hopes of increasing the price of the product. Construction of tuna impoundments began shortly and by 1937, fish were being successfully ranched in St. Margaret’s Bay (R. Conrad, personal communication; Butler, 1977). Despite logistical successes, market demand for bluefin remained consistently low and the operation was abandoned after only three years.

The start of World War II revived an interest in tuna meat, creating a domestic market for canned tuna and vitamins derived from tuna liver oil. Following post-war recovery of the world economy, however, demand decreased again and the industry reverted back to supplying the limited Boston market (R. Conrad, personal communication). The domestic Canadian market was reduced to canned tuna or processed pet food until 1970, when tightening regulations on mercury levels in predatory fish further limited these markets (Butler, 1977).

Following the mercury ban, trapnet tuna fishermen received short-term relief in the form of a bluefin tagging program carried out by the Department of Fisheries and Oceans (Butler, 1977). Shortly thereafter, an airline freight carrier developed a procedure for shipping fresh fish overseas, successfully opening a path to the robust Japanese market (R. Conrad, personal communication). In 1973, the first Canadian tuna was sold in Japan (Clay and Hurlbut, 1990). Despite mediocre prices of the low-fat fish, the Japanese buyers saw potential in the Canadian trapnet fishery and partnerships began to form (R. Conrad, personal communication).

By 1974, ranching of fish was re-introduced into St. Margaret's Bay and two experimental impoundments measuring 100m x 50m x 20m deep were built next to the existing mackerel traps (Hurley and Iles 1980, Butler 1977). Through June and July of 1974, up to fifty lean, early-season fish had been transferred into the impoundments from neighbouring mackerel traps (Butler 1977). These fish were fed locally purchased forage fish (e.g. herring (*Clupea harengus*) or mackerel culls, squid (likely *Illex illecebrosus*), gaspereau (*Alosa pseudoharengus*), silver hake (*Merluccius bilinearis*)) twice a day, consuming up to five percent of their body weight daily (Hurley and Iles, 1980; Butler, 1977). Each fish was kept over a period of one to four months and harvested once they reached optimum conditions for the Japanese sashimi market; in some years decreasing water temperatures would also result in an early harvest (Clay and Hurlbut, 1990; Butler, 1977).

This procedure was surprisingly successful and increased the market value of these fish four to eight times (Hurley and Iles, 1980). By 1976, with further logistic input from the Japanese buyers, St. Margaret's Bay contained nine impoundment nets, housing approximately 300 bluefin tuna throughout the year (**Figure 4**, Butler 1977). Following further economic success on the Japanese market the following year, the harvest doubled to a decade high of 948 fish in 1977 (Clay and Hurlbut, 1990). By 1978, eighteen impoundments had been established in St. Margaret's Bay and 87% of bluefin caught in the traps had been impounded and fattened (Hurley and Iles 1980). Seeing a prosperous future, the Japanese buyers began signing 5-year term contracts with the St. Margaret's Bay trapnet fleet (R. Conrad, personal communication).

These partnerships continued into the 1980s, when schools of bluefin tuna stopped coming into the bay (**Figure 5**). As only two bluefin tuna were reported in the 1986 landings from St. Margaret's Bay (**Figure 6**), the trapnet industry halted for almost a decade, while other fleets continued to land steady catches of the species (Clay and Hurlbut, 1990). The apparent regional change in migration routes forced the St. Margaret's Bay fishermen to venture outside the boundary line of the bay, where they found schools of bluefin tuna as close as two miles from the mouth of the bay (R. Conrad, personal communication). With this modified fishing effort, the trapnet industry reported a harvest of 340 fish in 1995 and, shortly after, schools of tuna began returning to St. Margaret's Bay (**Figure 6**).

3. Canadian bluefin tuna management structure

The Canadian tuna fishery allocates quota shares by fleet (longline, harpoon, hook and line/rod and reel, and trapnet), so there is no competition between fleets (**Table 1**). This allocation is based on each fleet's 10-year average historical landings. The St. Margaret's Bay trapnet fishery is considered its own fleet and is assigned 11.2% of the Canadian ICCAT quota (DFO 2010b). There are currently four fish trap licenses in the St. Margaret's Bay fleet, and those four licenses encompass 24 trapnets (**Table 1**). However, of those 24 trapnets, only nine are currently active, with fishermen picking up licenses, meeting license conditions, using tuna tags and submitting log books (fishing activity and catch records).

Since the late 1990s, the presence of bluefin tuna in St. Margaret's Bay has fluctuated (**Figures 5 and 6**). Both the total annual catch landed (**Figure 5**) and the mean size of the fish (**Figure 7**) show that during the late 1970s and 1980s, very large fish were being caught by the trapnet fishery. The decrease in the mean size in the recent past is consistent with the life history and reproductive strategy of a fishery targeting a species with a very long life span and could have reflected decreased abundance but as noted later, the traps are not necessarily adequate samplers of the western Atlantic bluefin tuna population. There is speculation that bluefin tuna catches diminished and increased with the absence or presence of forage species (mackerel and herring) (**Figure 8**). Although this is a reasonable assumption, the St. Margaret's Bay fishermen found abundant bluefin tuna within two miles of the mouth of the bay and there was no apparent significant change in mackerel abundance inside the bay (R. Conrad, personal communication).

The demand for Canadian bluefin tuna persists on the Japanese market. The inventory of impounded bluefin tuna captured in the traps and held for future harvest is dictated by the fluctuating presence of bluefin tuna in the bay, the costs for holding and feeding the fish and the market demand as reflected in the price.

4. Conclusions

We do not consider Canadian trap data to be an appropriate basis for an index of abundance, as the trap catch data are not indicative of bluefin tuna abundance outside of St. Margaret's Bay. During the 1980s and 1990s, trapnet catches within the bay were minimal or non-existent, while other fleets continued to land bluefin tuna. Catch data during the 1990s are not indicative of population abundance inside St. Margaret's Bay either, as

bluefin tuna were caught in open water, then impounded and harvested inside St. Margaret's Bay. Effort calculations during the 1990s are further skewed by the practice of catching tuna outside the bay, then bringing them in for impoundment. The effort associated with this practice has not been quantified or assessed. Due to the short time frame of the data set, the number of variables and the variance in the data that exist, the Canadian trap data does not appear to justify the effort necessary to analyze it and calibrate it with other indices.

Although the Canadian traps are not an appropriate source of data to use as an index of abundance, they have provided an excellent source of material for research on bluefin tuna. The studies include research on distribution and migration using conventional, archival and popup satellite tags. Studies on direct age estimation from otoliths, microconstituent analyses of otoliths and genetic studies are at the cutting edge of fisheries research. Such research is reshaping historic assumptions of the life history of bluefin tuna. This research has been facilitated because of the unique opportunity to sample bluefin tuna from the traps in St. Margaret's Bay.

Acknowledgements

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Table 1. Allocation of Canadian bluefin tuna catch by fleet. Asterisk indicates quota which has been adjusted to reflect unharvested (or overharvest) by the various inshore fleets. Source: DFO Archived Quota Reports (2004-2006, DFO 2010a) and DFO Integrated Fisheries Management Decisions (2007-2010, DFO 2010b).

<i>Fleet</i>	<i># License Holders</i>	<i>2004</i>		<i>2005</i>	<i>2006</i>	<i>2007</i>		<i>2008</i>	<i>2009</i>	<i>2010</i>
		<i>% of Quota</i>	<i>Quota (mt)</i>	<i>Quota (mt)</i>	<i>Quota (mt)</i>	<i>% of Quota</i>	<i>Quota (mt)</i>	<i>Quota* (mt)</i>	<i>Quota (mt)</i>	<i>Quota* (mt)</i>
South West Nova Scotia	42	22.06	131.48	136.79	185.46	21.70	106.73	137.99	102.93	98.59
St. Margaret's Bay	24	11.46	68.30	104.22	27.92	11.27	55.44	66.63	53.46	52.47
Newfoundland and Labrador	55	13.05	77.78	119.93	49.15	12.84	63.13	72.00	60.90	61.53
Quebec	54	5.17	30.81	29.85	40.88	5.09	25.01	26.54	24.10	20.19
Prince Edward Island	360	30.52	181.9	186.63	250.40	30.02	147.66	150.22	138.77	132.15
Gulf Nova Scotia	135	11.46	68.30	67.26	96.34	11.27	55.44	53.64	50.53	49.98
Gulf New Brunswick	107	6.29	37.49	33.36	52.76	7.81	38.43	42.54	37.09	17.52

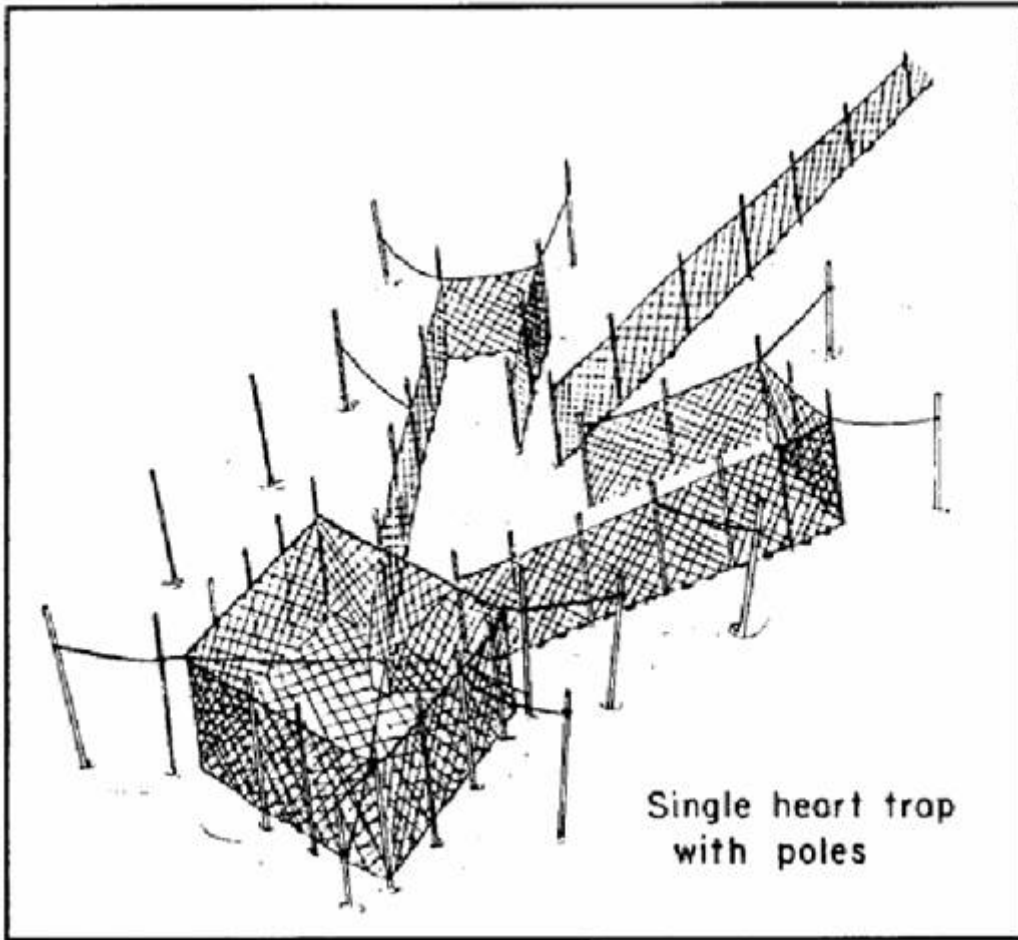


Figure 1. Typical U.S. single leader trap for mackerel and squid (U.S. Fish and Wildlife Service, as cited in Stansby and Dassow, 1963).

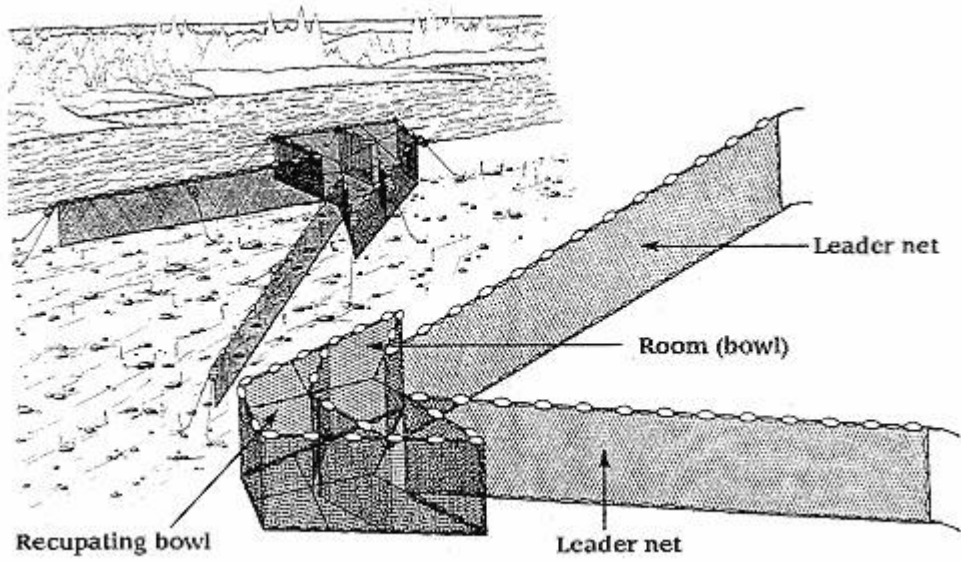


Figure 2. Typical Canadian double leader trap for mackerel. Image property of Les Industries Fipecc Inc. Grande-Riviere, Quebec, Canada.

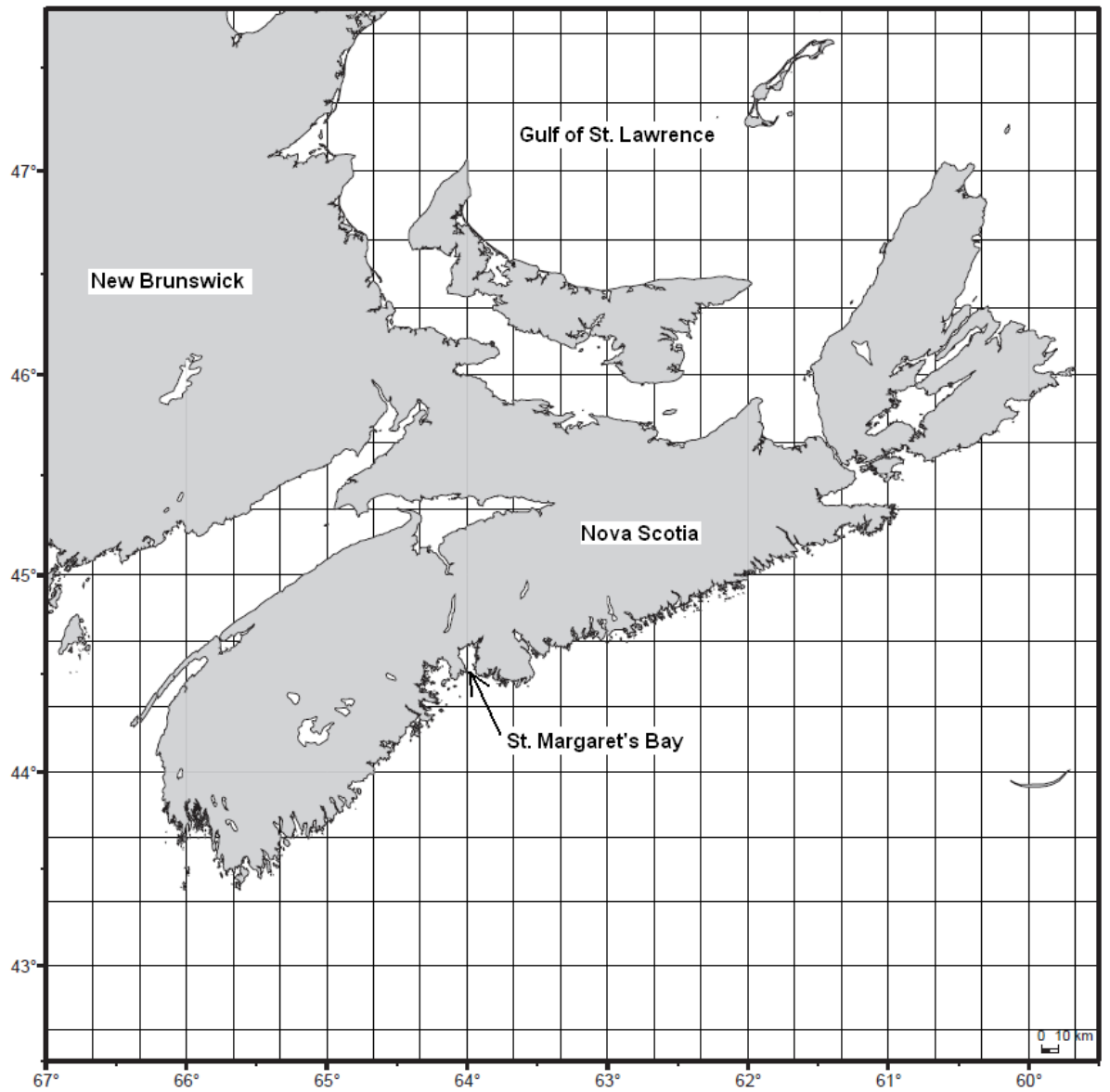


Figure 3. Location of St. Margaret's Bay, Nova Scotia, Canada (Source: DFO Virtual Data Centre).

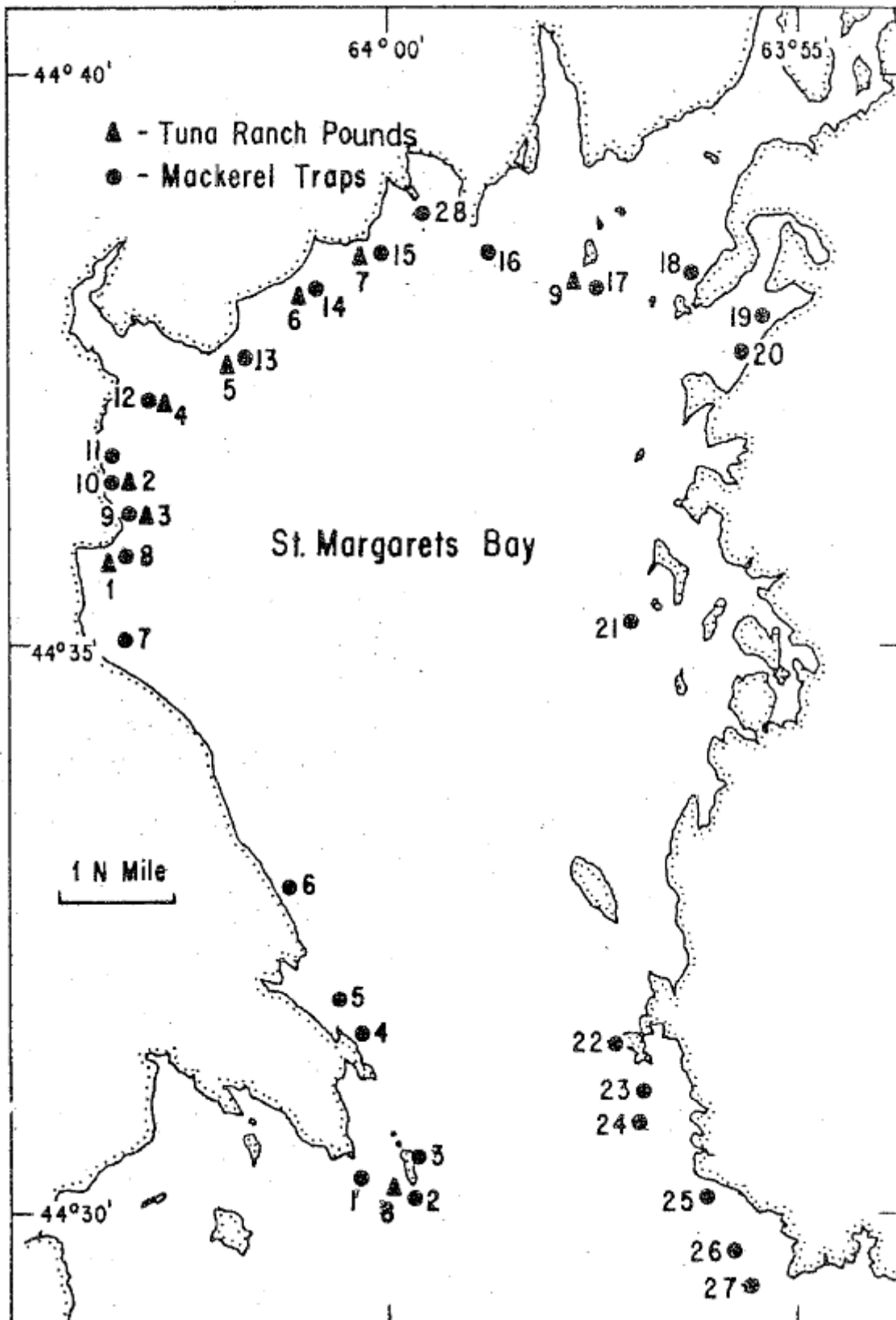


Figure 4. The location of 28 Mackerel traps (circle) and nine bluefin tuna impoundment nets (triangle) in St. Margaret's Bay, Nova Scotia as of 1976 (Butler, 1977).

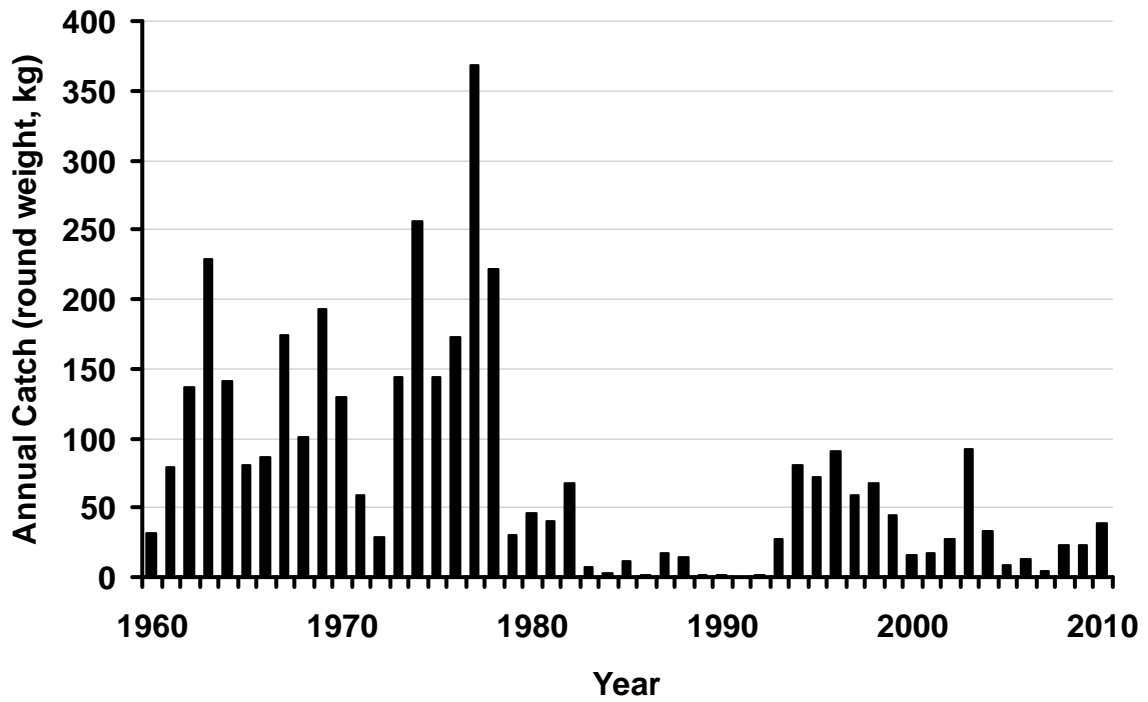


Figure 5. Annual reported round weight catch (mt) of bluefun tuna by the Canadian trapnet fleet in St. Margaret's Bay, Nova Scotia (Source: Hurley and Iles, 1980; Clay and Hurlbut, 1990; DFO quota archives.)

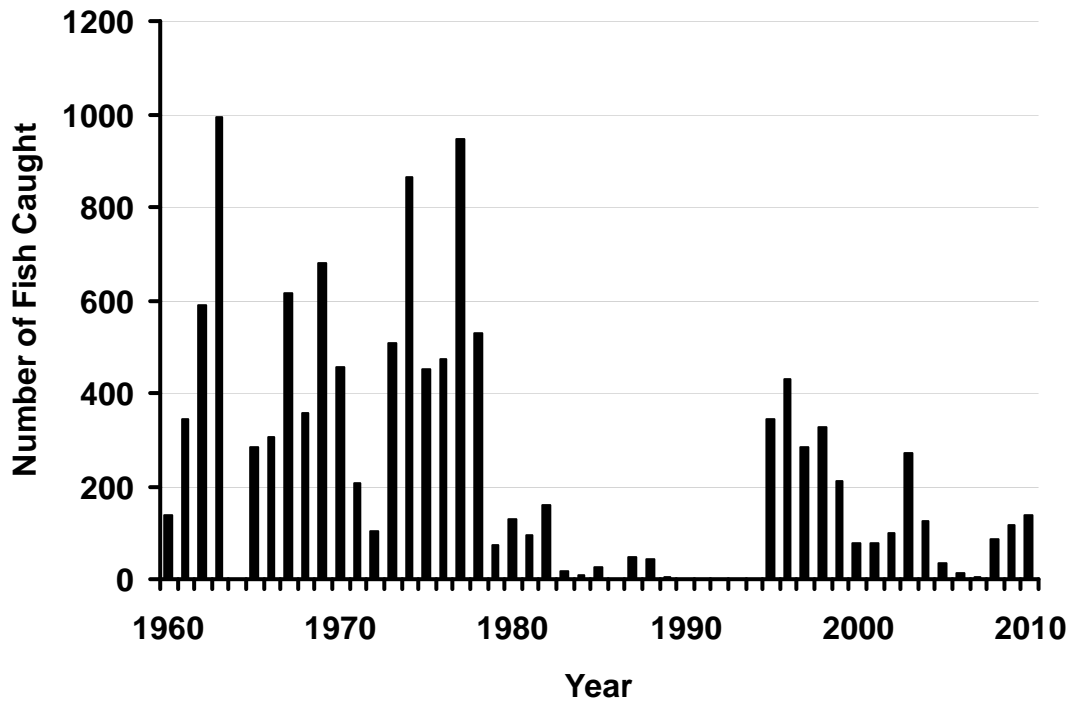


Figure 6. Annual catch (number of fish) of bluefin tuna by the Canadian trapnet fleet in St. Margaret's Bay, Nova Scotia (Source: Hurley and Iles, 1980; Clay and Hurlbut, 1990; DFO quota archives).

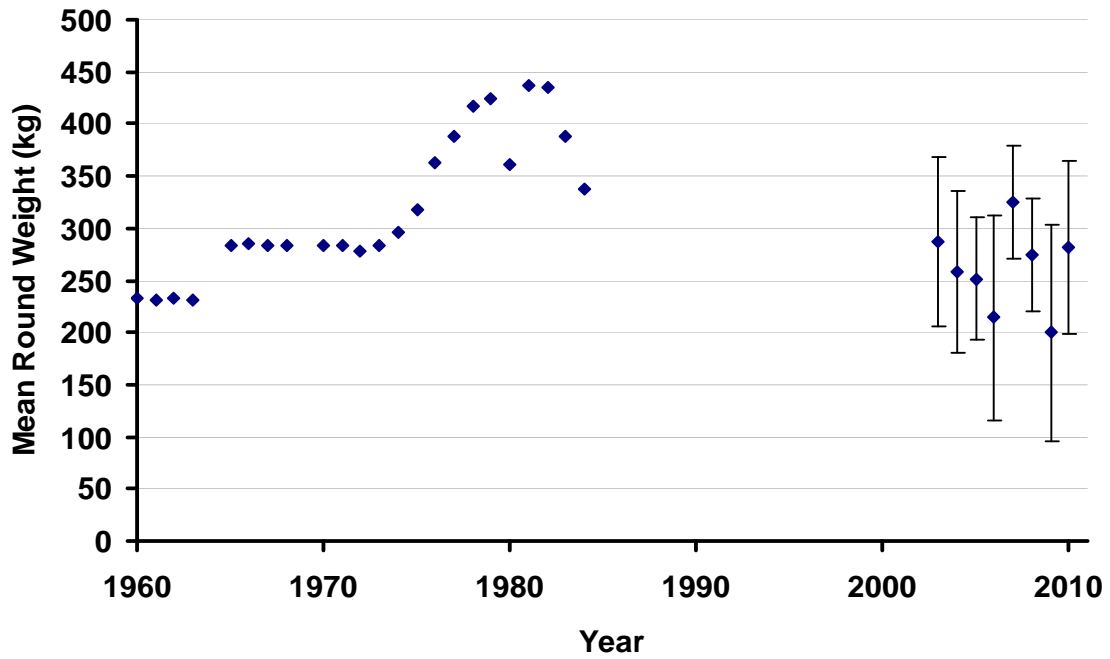


Figure 7. Mean annual round weight (kg) of individual bluefin harvested in St. Margaret’s Bay by the Canadian trapnet fleet. Error bars indicate standard error. No reliable data are available between 1986 and 2002; values prior to 1988 come from Hurley and Iles (1980) and Clay and Hurlbut (1990); these values do not contain a measurement of error. Data post 2002 come from the DFO tallies database and have been corrected for dress condition.

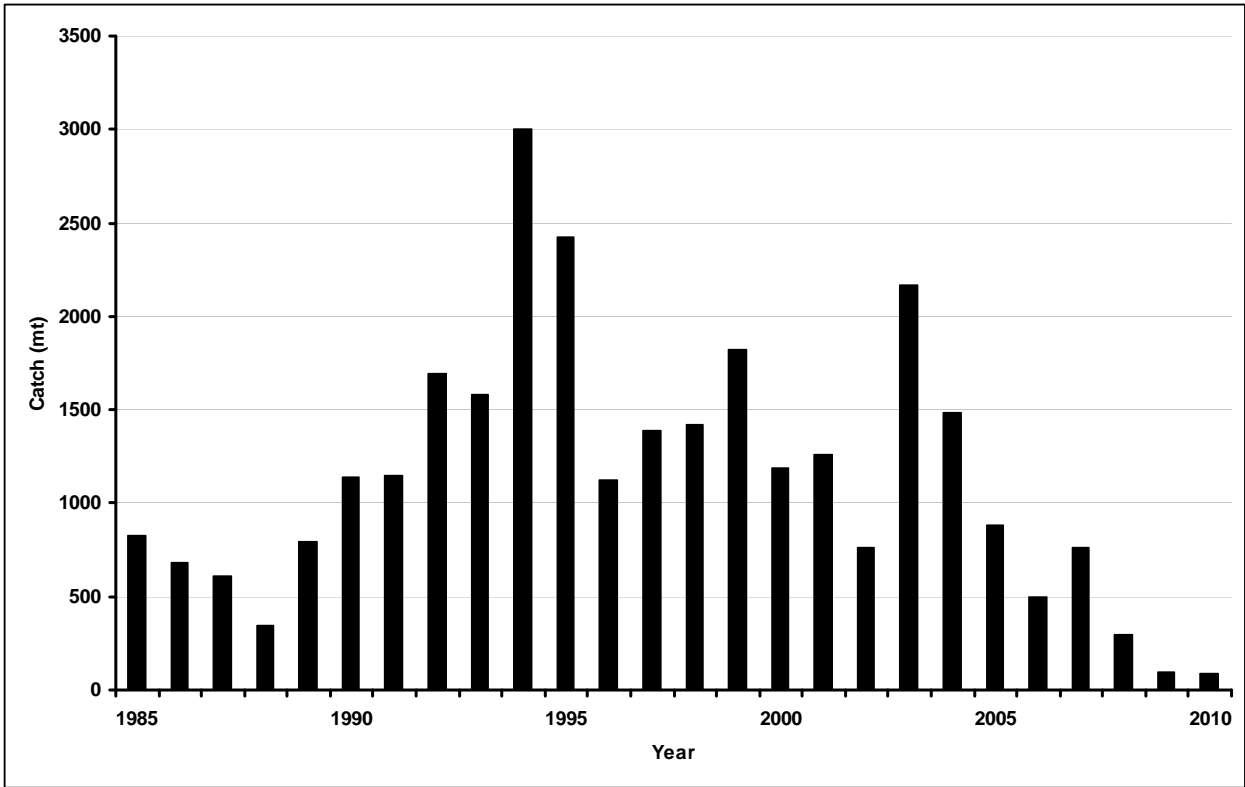


Figure 8. Annual combined catch (mt) of Atlantic Mackerel in district 23 (St. Margaret’s Bay, Nova Scotia and surrounding ports).