Fisheries and Oceans Canada | Pêches et Océans Canada
Ecosystems and Oceans Science | Sciences des écosystèmes et des océans

Canadian Science Advisory Secretariat
Gulf Region | Science Response 2022/031

ADVICE ON THE DIMENSIONS OF THE ESCAPE MECHANISM IN AMERICAN LOBSTER (*HOMARUS AMERICANUS*) COMMERCIALFISHING TRAPS IN THE SOUTHERN GULF OF ST. LAWRENCE

Context

The escape mechanism on commercial American Lobster (*Homarus americanus*) fishing traps is a key conservation measure as it allows under-sized Lobsters to exit the trap. This in turn reduces injury and mortality to these Lobsters, both within the traps (e.g., from other Lobsters) and at the surface (e.g., from handling and from predation upon return to the water). In addition, the escape mechanism can allow non-target species [e.g., Rock Crab (*Cancer irroratus*)] to exit Lobster traps. The minimum required dimensions of the escape mechanism form part of the Lobster management measures and are dependent on the Minimum Legal carapace Size (MLS) as larger Lobsters need larger openings to exit the traps. For example, the 2022 management measures for Lobster Fishing Areas (LFAs) 23, 24, 26A and 26B, provide two options for minimum escape mechanism length, 127 mm and 254 mm, and indicate the corresponding minimum escape mechanism heights required at MLSs of 73 mm to >76 mm and 73 mm to 80 mm, respectively (DFO 2022). As the MLS is now 82.5 mm in Lobster Fishing Area (LFA) 26B, and may eventually reach 80 mm or above in other LFAs, Fisheries Resource Management requested advice on the height and length of the escape mechanism at larger MLSs.

This Science Response Report results from the Regional Peer Review of May 4, 2022 on Advice on the dimensions of the escape mechanism in American lobster (*Homarus americanus*) commercial fishing traps in the southern Gulf of St. Lawrence.

Background

In the southern Gulf of St. Lawrence (sGSL) commercial Lobster fishery, the mandatory use of escape mechanisms began a progressive implementation in 1986 (Mallet et al. 2006). By 1996, all commercial Lobster traps in the sGSL had to be equipped with a rectangular escape mechanism to allow under-sized Lobsters to exit the traps (Mallet et al. 2006). The minimum dimensions of the escape mechanism at this time were set at 40 mm in height by 127 mm in length. The minimum height and length were the same throughout the sGSL and were not based on the MLS.

In 2004, DFO-Science conducted an experiment on escape mechanisms for Lobster traps that tested mechanisms up to 44.5 mm in height with a constant length of 152 mm (Comeau et al. 2008). The results of this experiment were used to develop management measures on escape mechanism height and length in relation to MLS. Final escape mechanism dimensions for a particular MLS were determined following discussions with industry in the mid-2000s, and taking into consideration what was manufactured and used in fisheries in areas with larger MLSs. An overall 75% efficiency in retaining lobsters at the MLS was adopted for the escape

mechanism, as a compromise between retaining the maximum number of legal sized lobsters and allowing the maximum number of sub-legal sized lobsters to escape.

In addition to the experiment conducted by DFO-Science, a similar experiment was completed in the USA which tested Lobster escape mechanisms from 50.8 to 55.6 mm in height with a constant length of 146 mm (Estrella and Glenn 2006).

Analysis and Response

The DFO led experiment (Comeau et al. 2008) used a logistic regression to determine the selectivity of five escape mechanism heights, to a maximum of 44.5 mm, with a constant length of 152 mm. Models assuming equal fishing intensity between the test trap and the control trap (i.e., p = 0.5) were more parsimonious than models estimating fishing intensity (Comeau et al. 2008) and those results are used here. Consistent with the current approach in the sGSL commercial Lobster fishery, which aims for a 75% efficiency in retaining lobsters at the MLS, the parameter estimates from these logistic selectivity curves were used todetermine the Lobster carapace length with a 75% retention for each escape mechanism height (Table 1) using the equation (adapted from Comeau et al. 2008):

$$L = (\ln(3) - a)/b$$

Where L is the carapace length of Lobsters with a 75% retention rate and a and b are parameters of the logistic curve, with probability fixed at 0.5 (from Table 16 in Comeau et al. 2008).

Estrella and Glenn (2006) tested four escape mechanism heights, from 50.8 mm to 55.6 mm, with a constant length of 146 mm, which resulted in a 75% retention rate for Lobsters from 90 to 99 mm in carapace length (values derived from Figure 8 in Estrella and Glenn 2006, Table 1). As the escape mechanism lengths tested in these two experiments were similar (i.e., 152 mm and 145 mm), the impact of the difference in lengths was assumed to be negligible, the datasets were combined and a linear regression was completed (Figure 1). The results of the linear regression were used to calculate the minimum escape mechanism heights for a 75% retention rate of Lobsters at carapace lengths from 80 mm to 95 mm (Table 2).

Table 1. American Lobster carapace length (mm) at a 75% retention rate for nine escape mechanism heights (mm)

Escape height (mm)	Carapace length (mm) at 75% retention rate	Data source
38.1	63.8	Comeau et al. 2008; Table 16
39.6	70.3	Comeau et al. 2008; Table 16
41.8	73.0	Comeau et al. 2008; Table 16
43.4	75.8	Comeau et al. 2008; Table 16
44.5	79.8	Comeau et al. 2008; Table 16
50.8	89.6	Estrella and Glenn 2006; Figure 8
52.4	90.3	Estrella and Glenn 2006; Figure 8
54.0	93.6	Estrella and Glenn 2006; Figure 8
55.6	98.6	Estrella and Glenn 2006; Figure 8

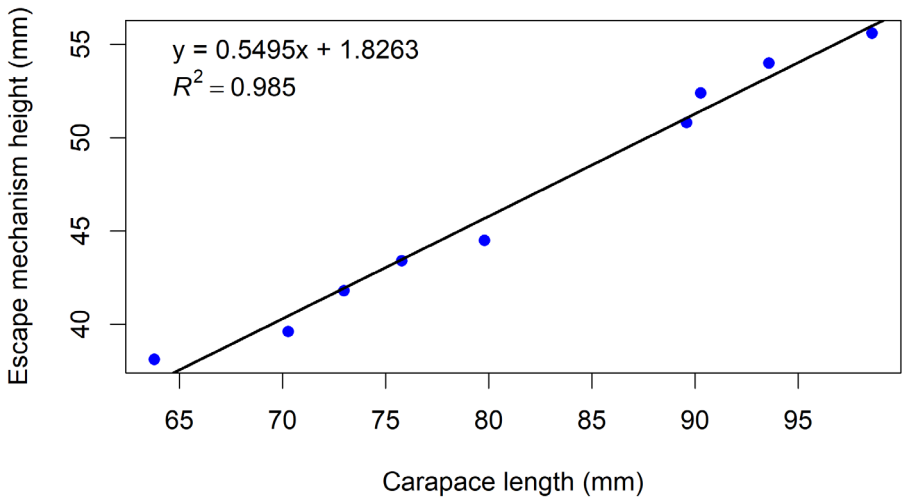

Figure 1. Escape mechanism height (mm) for a 75% retention rate of American Lobster at a given carapace length (mm) (data from Comeau et al. 2008 and Estrella and Glenn 2006).

Table 2. Escape mechanism height for a 75% retention of Lobsters at carapace lengths from 80 to 95 mm

Carapace length (mm)	Height of escape opening (mm)
80	46
81	46
82	47
83	47
84	48
85	49
86	49
87	50
88	50
89	51
90	51
91	52
92	52
93	53
94	53
95	54

To our knowledge, research is not available on the impact of variations in the length of the escape mechanism. However, as Lobsters often exit traps sideways and not head first (Comeau et al. 2008), longer escape mechanisms are likely to further facilitate the movement of sub-legalsized Lobsters out of the traps.

Conclusions

Maintaining the efficacy of escape mechanisms within American Lobster traps is key to the success of this conservation measure. As the MLS increases within the sGSL commercial Lobster fishery, as should the dimensions of the escape mechanism. Table 2 provides the height of escape mechanisms for a 75% retention rate of Lobsters at carapace lengths from 80 to 95 mm. Longer escape mechanisms are likely to further facilitate the movement of sub-legal sized Lobsters out of the traps.

Contributors

Name	Affiliation
Asselin, Natalie	DFO Science, Gulf Region
Cook, Adam	DFO Science, Maritimes Region
DeJong, Rachel	DFO Science, Gulf Region
Dwyer, Alan	DFO Resource Management, Gulf Region
McDermid, Jenni	DFO Science, Gulf Region
Surette, Tobie	DFO Science, Gulf Region
Zisserson, Ben	DFO Science, Maritimes Region

Approved by

Matthew Hardy
Regional Director, Science Branch
Gulf Region
June 22, 2022

Sources of Information

This Science Response Report results from the Regional Peer Review of May 4, 2022 on Advice on the dimensions of the escape mechanism in American lobster (*Homarus americanus*) commercial fishing traps in the southern Gulf of St. Lawrence.

Comeau, M., Hanson, J.M., Rondeau, A., Mallet, M., and Chassé, J. 2008. Framework and assessment for American lobster, *Homarus americanus*, fisheries in the southern Gulf of St. Lawrence: LFA 23, 24, 25, 26A and 26B. DFO Can. Sci. Advis. Sec. Res. Doc. 2008/054. ii + 111 p.

DFO. 2022. 2022 - Southern Gulf of St-Lawrence Lobster conservation harvesting plan for Lobster Fishing Areas (LFAs) 23, 24, 26A and 26B. Notice to Fish Harvesters: 3 p.

Estrella, B.T., and Glenn, R.P. 2006. Lobster trap escape vent selectivity. Mass. Div. Mar.Fish. Tech. Rep. TR-27: iv + 15 p.

Mallet, M., Comeau, B., Gagnon, D., and Comeau, M. 2006. At-sea sampling data collection and fishery regulations for the southern Gulf of Saint Lawrence lobster (*Homarus americanus*) fishery–1982–2000. Can. Manuscr. Rep. Fish. Aquat. Sci. 2769: v + 105 p.

This Report is Available from the:

Center for Science Advice (CSA)
Gulf Region
Fisheries and Oceans Canada
343 Université Ave.
Moncton, NB, E1C 9B6

E-Mail: DFO.GLFCSA-CASGOLFE.MPO@dfo-mpo.gc.ca
Internet address: www.dfo-mpo.gc.ca/csas-sccs/

ISSN 1919-3769
ISBN 978-0-660-44388-1 Cat. No. Fs70-7/2022-031E-PDF

Correct Citation for this Publication:

DFO. 2022. Advice on the dimensions of the escape mechanism in American lobster (*Homarus americanus*) commercial fishing traps in the southern Gulf of St. Lawrence. DFO Can. Sci. Advis. Sec. Sci. Resp. 2022/031.

Aussi disponible en français :

MPO. 2022. Avis sur les dimensions du mécanisme d'échappement des casiers de pêche commerciale du homard (Homarus americanus) dans le sud du golfe du Saint-Laurent. Secr. can. des avis sci. du MPO. Rép. des Sci. 2022/031.