

## Supplementary Materials and Methods

### ***Pre-training method***

The pre-training (constituted of five consecutive steps, Figure S1) consisted in training octopuses to open two pots within 30 minutes two times a day to obtain a food reward. Plastic pots (70mm x Ø35mm) opacified with grey tape (from step 2) and hermetically closed with Parafilm® (from step 3) were used during the experiment.

First step: Octopuses were presented with one open transparent pot containing a crab they should grab and eat. Two trials were conducted per day. When octopuses ate the content of at least one pot for three consecutive training days, they went to step 2.

Second step (no access to visual cues): Octopuses were presented with one open pot surrounded by opaque tape containing a crab they should grab and eat. Three trials were conducted per day. When octopuses ate the content of the three pots within a day, they went to step 3.

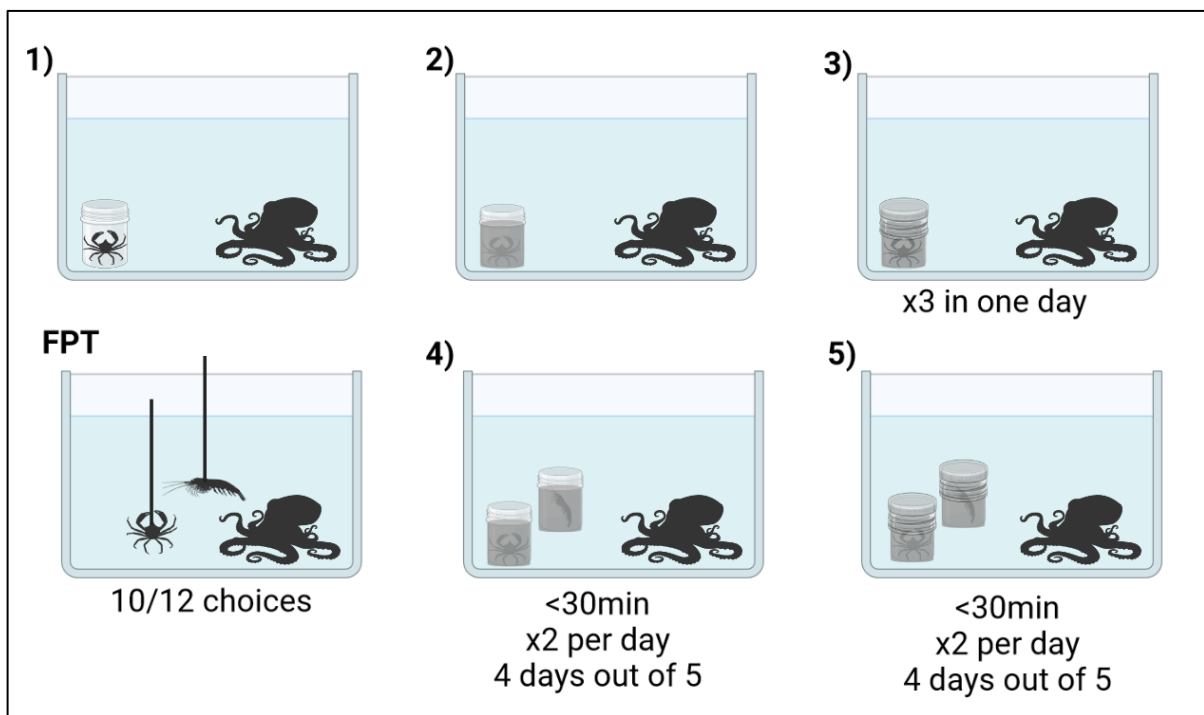
Third step (no access to visual and olfactory cues): Octopuses were presented with one pot surrounded by opaque tape and tightly covered with Parafilm®. Three trials were conducted per day. When octopuses opened the three closed opaque pots within a day, they went to step 4.

Fourth step (no access to visual cues): Two open opaque pots were simultaneously presented in the tank (random positions along trials). Each pot contained a different prey, from the two prey items used for the preference test. When octopuses retrieved food items from the two pots in less than 30 minutes, two times a day for at least four out of five consecutive training days, they went to step 5.

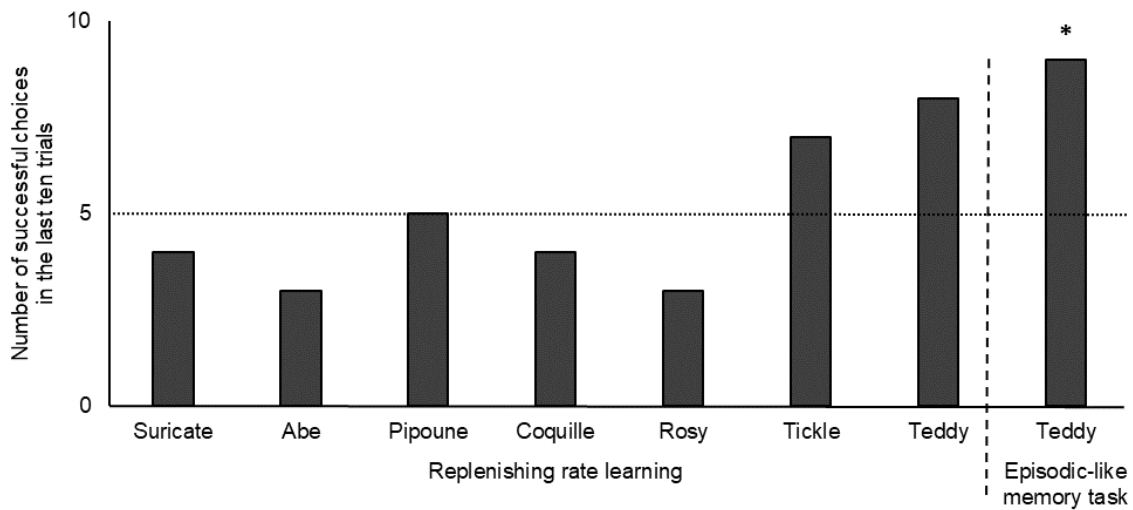
Fifth step (no access to visual and olfactory cues): The procedure used was the same than the one used during step 4, excepting that pots were closed with Parafilm®. The octopus had to consume the food of the two pots in less than 30 minutes, two times a day for at least four out of five consecutive training days to start the replenishing rate training.

Food preference test

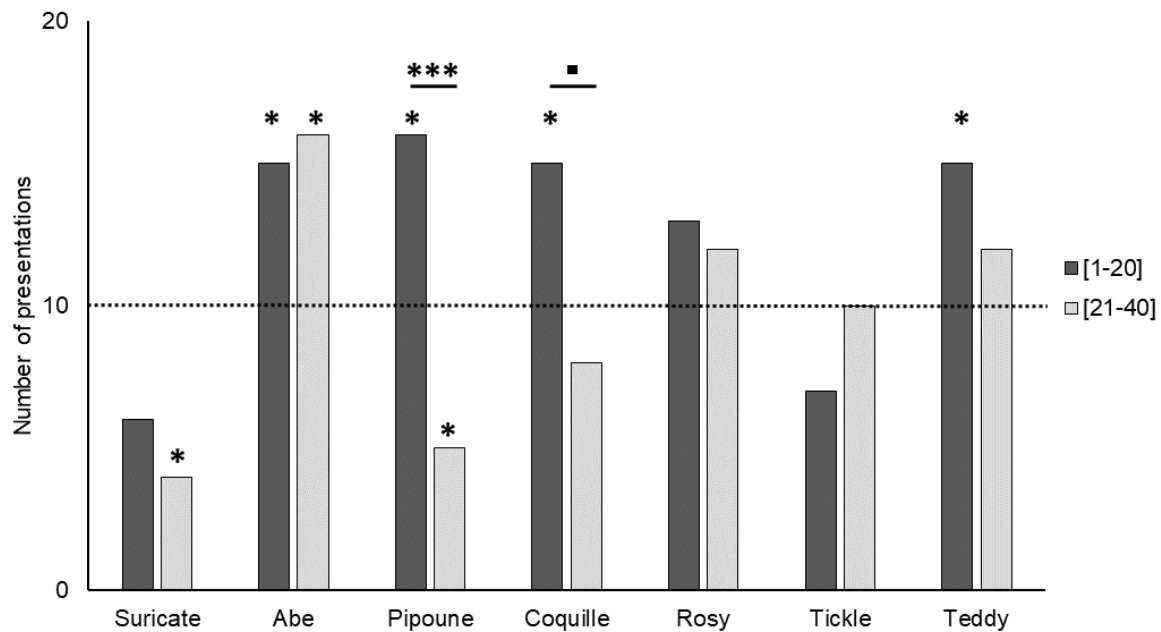
Prey preferences of each individual subject was tested between the step 3 and 4 of pre-training. General avoidance of certain types of food was noted during pre-training. Only preys which were not avoided were randomly tested two by two during the food preference tests. Two different prey types were placed at the tip of two steel wires and simultaneously presented at equal distances to the octopus (about 10 cm), with the right/left position of each prey type randomized between trials. The octopus chose a prey item by grabbing it and eating it. Preference was assessed when octopuses choose one type of food over the other in at least 10 out of 12 consecutive trials (binomial test,  $p=0.039$ ).



**Fig. S1. Sequence of pretraining steps and the food preference test.** 1) Step 1: Octopuses learn to grab a crab inside a transparent open pot; 2) Step 2: Octopuses learn to grab a crab inside an opaque pot; 3) Step 3: Octopuses learn to open a closed opaque pot to eat a crab; FPT: Food preference test during which octopuses are given 12 times a choice between two types of food to determine their preference; 4) Step 4: Octopuses learn to eat preys out of two open opaque pots in less than 30 minutes two times a day, at least four out of five consecutive training days; 5) Step 5: Octopuses learn to eat the preys out of two closed opaque pots in less than 30 minutes two times a day, at least four days out of five consecutive days.



**Fig. S2. Number of successful choices in the last ten trials of the replenishing rate training and the episodic-like memory task.** None of the individuals, except Teddy, reached the learning criterion of eight successful responses out of ten consecutive trials during the replenishing rate training. Subsequently, only Teddy was tested in the episodic-like memory task, and reached the acquisition criterion of 10 out of 12 successive trials. The asterisk represents a number of success significantly different from chance (i.e. dotted line; binomial test, \*  $p < 0.05$ ).



**Fig. S3. Individual use of risk-sensitivity (in number of risky choices) during the first 20 and the last 20 trials of replenishing rate training** (see methods and Fig.2 for description of risk-sensitivity). High inter-individual and intra-individual variability in risk-sensitivity was observed: some individuals did not show any risk-sensitivity throughout the training (Rosy, Tickle), while other showed a steady risk-proneness (Teddy) or risk-aversion (Suricate); and some others showed risk-proneness during the first 20 training trials and reversed to risk-aversion or risk-indifference during the last 20 training trials (Pipoune, Coquille). Asterisks represent significant difference from chance (*i.e.* dotted line; binomial test, ■  $0.06 < p < 0.05$ , \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ ).