

Latest Feedback-analysis: Whale-PAL effectively protects from orca attacks

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The central question is: does the Whale-PAL really protect your vessel? Until February 2026, around 700 users of the Whale-PAL were contacted and asked for feedback on their experiences with the acoustic warning device. 371 sailors reported back, the device was deployed and towed 304 times in the “Orca Alley”. All results were compared with literature data on sailing without Whale-PAL (control).



Abb. 1: Killer whale (Orcinus orca)

Conclusion: 302 of 304 passages with the Whale-PAL went without problem, a proportion of 99.3% as opposed to 89% of passages without taking any measures.

The Whale-PAL increases the chance of not seeing any orcas at all: in 258 passages with the acoustic device, there were no killer whale sightings at all, a proportion of 85%, whereas 75% were expected from control.

46 sailors with Whale-PAL reported an orca interaction: there were 44 sightings and,

very early on in whale-PAL development, 2 damaged vessels in 2023. With the Whale-PAL you get away safely in 95,7% of all interactions (100 % since 2023), but without it it's only 50%. All differences are statistically highly significant (binomial test).

The evaluation of the feedback shows that the repeatedly improved Whale-PAL, with its specific towing rig and its unique acoustic signal, measurably reduces the risk of an orca attack. This proves again and with the latest data the effectiveness of the whale-PAL as a protective measure for sailors.

A summary on the [background of orca attacks](#) on boats can be found here.

What feedback is there from Whale-PAL users?

The questionnaire asked whether the Whale-PAL (Pat.; Culik, 2013) had been deployed, in which marine area, and whether there had been orca (killer whale) sightings, interactions or damage. 371 of around 700 users shared their feedback (Tab. 1). Of these, sailors had deployed and towed the Whale-PAL in 304 passages through the “Orca Alley (some sailed several times). 92 sailors did not sail the orca alley or even gave up sailing completely (category “Not sailed”).

Of the total of 304 passages through Orca Alley, 258 went without sighting any orcas at all, 20 skippers reported a sighting in the distance, and 24 a sighting close to the boat (within 100 meters).



Two yachts were attacked early on during development, in 2023, despite towing their Whale-PAL. The term “interaction” summarizes sightings and attacks, so a total of 46 interactions were reported. Users reported 51 attacks on yachts close by, but they themselves were almost always spared. The most recent feedback from the sailors surveyed is posted at <https://www.f3mt.net/whale---pal.html>.

Table 1: Analysis of feedback from Whale-PAL users. 302 of 304 passages went without problems when the Whale-PAL was deployed, a proportion of 99.3%. “Interaction” adds up sightings near and far as well as damage. For further explanations please see text.

Category	Observations	Proportion (%)
Sailor feedback	371	
Not sailed	92	
Sailing trips	304	
- PAL Stby	64	21,1%
- PAL deployed	240	78,9%
No damage	302	99,3%
No sighting	258	84,9%
Damage nearby	51	16,8%
Interaction:	46	15,1%
-Sighting dist.	20	6,6%
-Sighting near	24	7,9%
-Damaged vessel	2	0,7%
PAL:		
-Tail broken	6	2,5%
-Bite marks	5	2,1%
-Leakage	2	0,8%
-Total loss	17	7,1%

In most cases, towing a Whale-PAL worked without any problems. The rig has been continually optimized based on ongoing feedback, the stainless steel line is now equipped with press sleeves, the swivels and shackles on the paravane are made of stainless steel or are nickel-plated, the PAL is towed on a Dyneema line and is now equipped with a tail unit keeping it in track. Many sailors reported that the system worked very well for them.

However, some sailors were unlucky: one captain forgot to retrieve his Whale-PAL before anchoring, another was able to recover his with difficulty after a collision with a fishing net and yet another had a collision with a tree trunk and lost the device. Attacks by fish were most common: in total there were bite marks on 5 PALs. A sailor reports that a large fish turned his yacht 90 degrees before the PAL broke off. 17 PAL were lost at sea (7.1%). To avoid loss at sea, we have increased the breaking load of swivels to 220 Kg as of 2025. The fin of another 6 devices broke (we have improved its design



since, no more damages reported since) and 2 PALs leaked (probably also due to a fish attack). The attacking fish include potentially large sharks and tuna, but so far only one shark has been directly observed.

Is the Whale-PAL effective and how is this measured?

To sum it up: yes. In order to prove the effectiveness of a method, you need a control. In other words: what would have happened if the Whale-PAL had not been used? Would the sailor in question have been attacked during an orca sighting? With what probability?

In their study, Lopez and Esteban (2021) provide the only available information that I am aware of on the expected damage frequency after an “interaction”. They compiled this data through inspection of 19 ships, feedback from 145 skippers, as well as reports in the press and social media. In 214 of the sightings and attacks collected in 2020 and 2021, damage occurred in 119 ships, or 56% of the cases (Table 2 “Control 1”).

Table 2: The damage caused by orca interactions to marine vessels without Whale-PAL (Control 1 and 2; from Lopez and Esteban, 2021) reached a mean of 50% in 2020 and 2021.

Category	Control 1		Control 2		Whale-PAL	
	Obs.	Proport.	Obs.	Proport.	Obs.	Proport.
No damage	95	44%	22	55%	46	96%
Damages	119	56%	18	45%	2	4%
Sum	214	100%	40	100%	48	100%

In their report, Lopez and Esteban (2021) also mention another, comparable study based on information in social networks (Table 2, “Control 2”). Of the 161 anonymous sailors recorded who Expect sailed Orca Alley in 2021, 121 had no sightings or problems (75%), while 12 reported orca sightings, 10 reported problems with orcas, and 18 reported damage. Out of a total of these 40 interactions, damage occurred in 18 cases, a damage frequency of 45%. Averaging both studies, **an interaction without Whale-PAL deployment results in a damage probability of around 50%.**

Sailors using the Whale-PAL report 46 interactions during 304 passages through the Orca Alley (see Table 1; 20 near and 24 distant sightings, 2 damages). However, the number of damages was only 2, and not the 50% expected from the two controls in Table 2 - which would have been 23. This means that the probability of damage during deployment of the Whale-PAL was reduced from around 50% (Lopez and Esteban, 2021) to just $2/46 = 4\%$ (Fig. 2). By the way: whale-PAL users did not report any damages since end of 2023. **A sailor who tows his Whale-PAL has thus a very good chance of 96% (all data) or even 100% (data after 2023) of being able to continue his trip undamaged after sighting an orca.** But now is this just a coincidence or the effect of the Whale-PAL?

To check this, you can use a simple statistical test, the binomial test. (It also allows you to check if your dice are tricked). In this case we test 44 successful results in 46 attempts with an expected damage probability of 50%. The probability that the Whale-PAL is successful and that the result obtained is not due to coincidence is 99.9999%. The significance level is only 95%, so this result is highly significant. Or in other words, the risk of this being by chance is less than 0.0001 %.



We can reduce the data set even further and test whether the Whale-PAL also helps to ward off an attack when killer whales have been spotted near the boat. There were 22 passages without damage in 24 close interactions. The difference to the 12 damages expected (expected damage ratio 50%) is highly significant. With a probability of 99.9999% this is not due to chance.

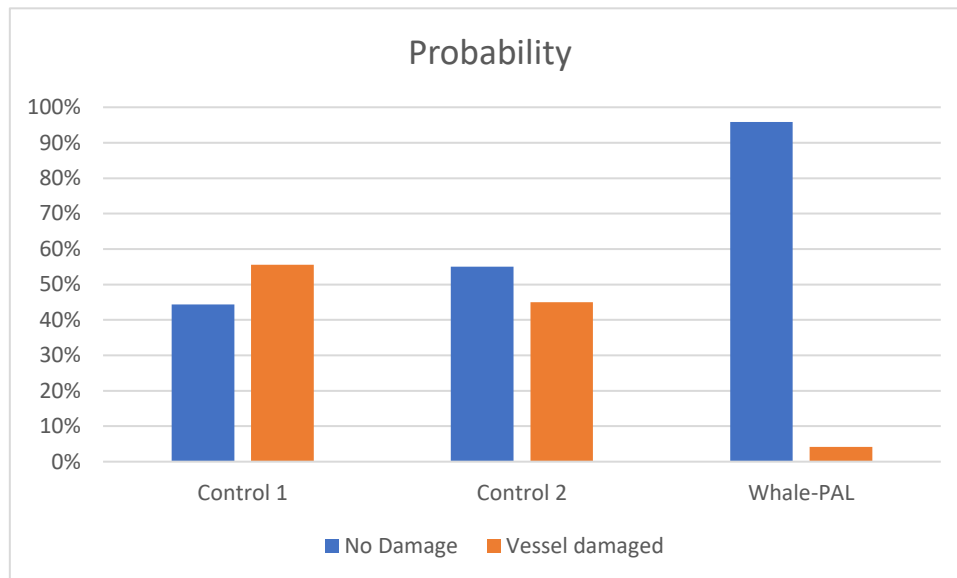


Fig. 2: The probability that a damage occurs during an orca-interaction is reduced from 45-56% (control 1 and 2) to only 4% when the Whale-PAL is deployed. The difference is highly significant.

One sailor reports: "An hour southeast, near Sagres, there is a bay where we wanted to anchor. We had the whale PAL on standby in the cockpit. There's a bar in front of the entrance to the bay, and it's about 25 meters deep there... As we were about to start furling the sails, about 100 meters from the entrance to the anchorage, the killer whales attacked. It was out of the blue, so to speak; we hadn't seen the animals coming. They dived straight toward the boat. There was no prior play with the boat, no surfacing, or swimming alongside.

The wind and waves were moderate, with a wind of about 10 knots, an old swell. We were heading for land when the killer whales grabbed our rudder and turned the boat 180 degrees toward the sea. Once the rudder was free again, we immediately reversed course, heading back toward the bay. I took the whale PAL out of the pouch and put it in the water. The attack stopped immediately. We later learned that two other yachts had been attacked by killer whales in the same area. They were less fortunate: both yachts had their rudders broken off. Since then, we've been towing our whale-PAL continuously when sailing along the Iberian coast."

The latest feedback from sailors is posted at <https://www.f3mt.net/whale---pal.html>.

What other comparisons can be made?

Sailors traveling with Whale-PAL sailed through the Orca Alley without any problems in 302 of 304 passages, that is 99.3% of the time. In contrast, in control 2 in the study cited by Lopez and Esteban (2021) only 143 out of 161 sailors (18 suffered a damage) were lucky, i.e. 88.8%. So, deploying the



Whale-PAL reduces the risk of damage from 11% to just 0.7%, a reduction of 94%. We ask the binomial test whether this could be a coincidence, no damage 302 out of 304 passages, even though the expected ratio is 89%. Result: 99.9999% not a coincidence.

Sailors towing the Whale-Pal reported that they had no orca sightings in 258 of 304 passages (84,9%). In the study cited by Lopez and Esteban (2021), there were 121 out of 161 sailors, i.e. only 75%, who had no sighting. Could it be that the Whale-PAL also reduces the number of interactions overall? The binomial-test shows that with a probability of 99.9999%, this is not due to chance. The Whale-PAL not only reduces the likelihood of damage after a sighting, but also that orcas come close enough to the boat to be even noticed and spotted.

However, one must be cautious when interpreting the frequency of sightings, as many users also reported using maps of recent interactions provided by websites such as orcas.pt or GTOA/Orcaiberica to actively avoid orca areas. Recent maps of orca interactions have only been available since 2022. And: some sailors report not having seen the orcas at all before an attack. Or detecting strange signals on their echo-sounder, indicating orcas diving unseen under the boat.

There was also a large difference between the 51 attacks reported by Whale-PAL users in close time and space proximity of their route (Table 1) compared to only 2 attacks on the users themselves. Here we are comparing within the user feedback data only. When you sail through Orca Alley towing a Whale-PAL and receive reports of damages in the immediate area, you have a 96.1% chance of getting through this hotspot unscathed. You already guessed it: the occurrence of 49 successes in 51 attempts (assuming a damage probability 50%) is due to chance. With 99.9999% probability.

So to make a long story short: one can twist and turn it, the Whale-PAL doubtlessly works and reduces the risk of orca-Interactions and damages. Significantly.

Notes

Since fall 2023, we have only been distributing the Whale-PAL v3. The device is half black and transparent, and thanks to the built-in LED, it's easy to see whether the battery is still full and whether the device is functioning properly.

The Whale-PAL's signal was adjusted after the two incidents in 2023 and modified so that it emits more quickly when launched into the water. The signal properties have also been adjusted so that the variable signal part now occurs more frequently. The instructions for use indicate more clearly the properties of the PAL and how to adjust it when the vessel is stopped.

Since the introduction of all these improvements in the fall of 2023, no further damage caused by orcas has been reported by whale-PAL users.

Sources

Culik, B., Conrad, M., L3-Communications Elac Nautik (2013) Patent "Vorrichtung zum Schutz von Zahnwalen vor lebensbedrohlichen, gesundheitsschädlichen und/oder beeinträchtigenden Gegenständen". DPM Nr.: 102011109955

López A, Esteban R (2021) Elaboración de un estudio científico sobre la interacción de la población de orca (*Orcinus orca*) del estrecho de gibraltar con embarcaciones, para el diseño y propuesta de medidas de prevención, actuación y gestión. [Intemares](#), 88 pp. ([Copy](#) here).