

A VISUAL GUIDE TO THE U.S. FLEET SUBMARINES
PART FOUR: GATO CLASS
(WITH A TAMBOR/GAR CLASS POSTSCRIPT)
1941-1945

BY

DAVID L. JOHNSTON

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The *Gato* class submarines of the United States Navy in World War II proved to be the leading weapon in the strategic war against the Japanese merchant marine. They were also a solid leg of the surface/air/submarine triad in the USN's tactical efforts to destroy the Imperial Japanese Navy. Their success in these roles came about because of over 20 years of concept refinement, research, and development of the Fleet Submarine. Because of this they have achieved iconic status in the minds of historians.

In 1940 and 1941, noting with alarm the chaotic war situation in Europe, the United States began building programs designed to rapidly expand the size of the armed services. The *Tambor/Gar*-class submarines of the Fiscal Year 1939 and 1940 programs (see the Postscript below) were well liked by the Navy. The six submarines of the FY-41 program were to be the *Gato*-class and were straight forward derivatives of the *Tambor/Gars* and nearly identical. The only significant difference was the addition of five feet in length to accommodate a watertight bulkhead in the engine room, dividing that large compartment into two smaller ones. Before the ink was even dry on this program the Navy Department was authorized a massive expansion that added 22 more boats to the program, and follow-on authorizations would eventually bring the total *Gato*-class submarines to 77.

Following the precedent set in earlier construction programs, the Portsmouth Navy Yard in Kittery, Maine and the Mare Island Navy Yard in Vallejo, California lead the Government effort, with the civilian Electric Boat Company in Groton, Connecticut being the prime civilian contractor. As usual, there were minor but distinctive differences between the Government and EB designs. To round out the massive building program, the Manitowoc Shipbuilding Company in Wisconsin was brought into the process, and they acted as a companion yard to Electric Boat, using the EB plans and many of the same equipment suppliers.

The *Gato* class started construction on 11 September 1940 with the *Drum* at the Portsmouth Navy Yard and ended on 26 October 1943 with the commissioning of the *Rock* at Manitowoc, Wisconsin. With a construction period spanning a time of tremendous change within the force, these boats were subjected to several distinct modifications to their outward appearance, with these configurations being distinct enough to allow their visual separation from the earlier *Porpoise/Perch*, *Salmon/Sargo*, and *Tambor/Gar* boats, and the later *Balao* and *Tench* classes. A number of the *Gatos* underwent no fewer than four of these extreme makeovers during the war years, with most getting at least three. The majority of these changes were centered around the conning tower fairwater in the center of the boat topside. This structure smoothed the flow of water around the conning tower and main air induction valve and provided a bridge area for the topside watchstanders while surfaced. It also formed the support structure for the mast and periscopes and platforms for lookouts.

The configurations of the fairwaters changed so much for several good reasons. First, the large, bulky original configuration, optimized for peacetime cruising, was great for reducing drag while submerged, but soon after the war started it was realized that this massive structure made the boats a huge visual target on the surface. Portions of the fairwater were quickly cut away in an effort to reduce the silhouette. Secondly, the rapid advances in radar, electronic surveillance measures, and communications technologies necessitated changes in the fairwater and shears in order to accommodate the masts and antennas for the new equipment. Third, the realization that the boats were going to spend a lot more time on the surface than was originally thought led to the desire to have a more powerful gun armament. The platforms created by reducing the silhouette of the fairwater made excellent mounting points for .50 caliber machine guns and the more powerful 20 mm and 40 mm automatic cannons.

These modifications, even though many were simple enough to be accomplished between patrols by a tender, had all been reviewed and approved by the ongoing Submarine Officers Conference and authorized by the Navy's General Board for design. Changes were made to the construction plans and were incorporated into the boats on the building ways. The changes were also rapidly disseminated to the fleet and were made to already commissioned boats during refit or overhaul. Goaded by anxious boat crews, some of these changes were probably done by tender and refit crews ahead of the official authorization and were completed on the fly.

There was actually a degree of uniformity to all of these changes. They were completed at different times based on approval by the General Board, and by the availability of new technologies. This allows the changes to be aligned into modification groups, helping to make sense of what was going on. The names of the Modifications (Mods) that I describe below are entirely of my own creation and do not reflect any official U.S. Navy nomenclature. I created the terms to make sense of what I discovered while doing research for this chapter.

MOD 1

When the follow-on authorizations to the initial FY-41 *Gato*-class began to flood in, it was decided to “freeze” the design for mass production. The original exterior architecture of the design was closely related to the preceding classes and it reflected a low-intensity peacetime cruising mindset. The fairwater was large and bulky, designed to provide the maximum amount of protection for the topside watchstanders and support for the periscopes and radio antennas. Counterintuitively, it was also intended to reduce drag and smooth the flow of water around all of the topside protuberances and increase submerged speed. However, its large size also made it easy to see while surfaced, a liability that was noted by some submarine personnel prior to the war. Calls to reduce it fell on deaf ears due to bureaucratic inertia and hidebound tradition. It would take the cold harsh reality of war to clear away those objections. All U.S. fleet submarines in commission at the start of the war in December 1941 made their initial patrols with this pre-war configuration. This original configuration is referred to as the Mod 1.

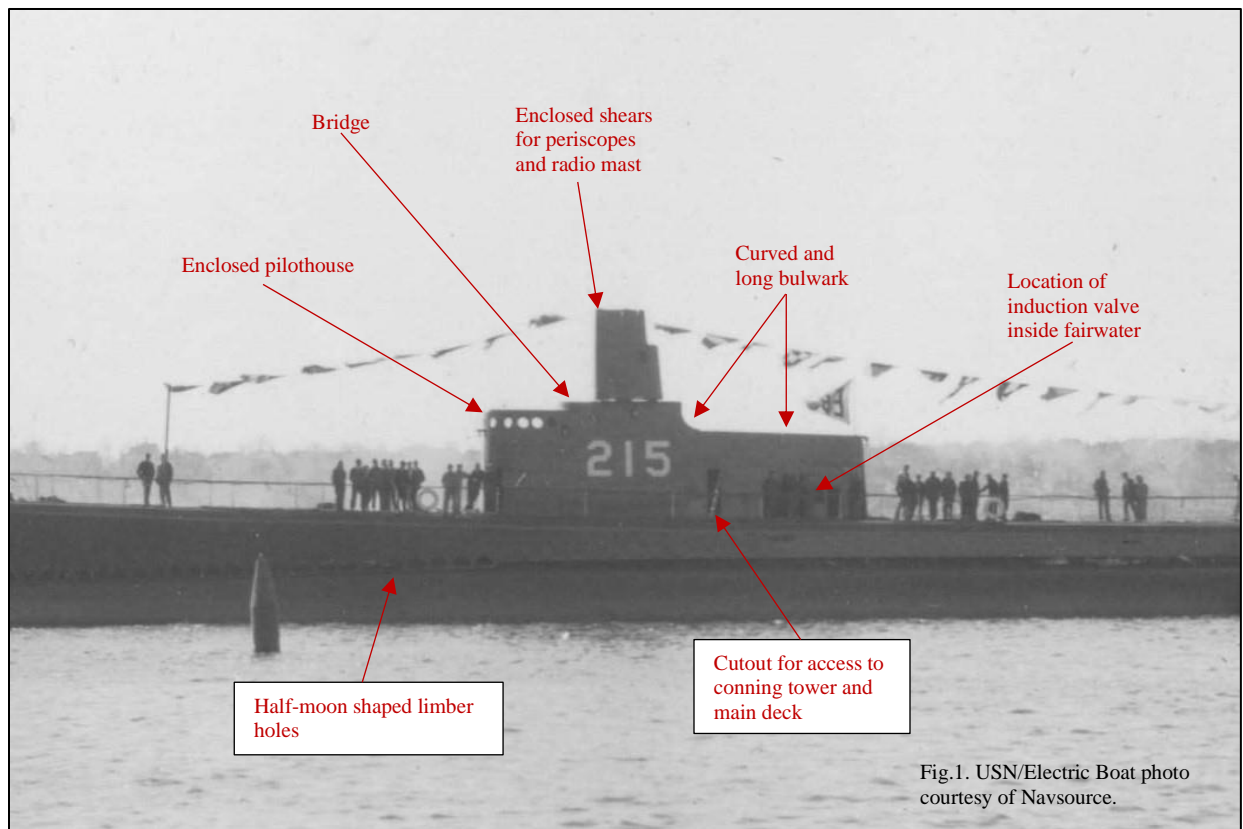


Fig.1. USN/Electric Boat photo courtesy of Navsource.

Figure 1 above shows *Growler*, taken on her launch day of 22 November 1941, and illustrates the Mod 1 EB design. At the forward upper end are a series of circular windows that let into a sheltered pilothouse for the bridge crew during surface transits, a much-appreciated feature during rough weather. It also housed an auxiliary steering station for the helmsman. Directly abaft, and raised slightly higher is the open-air bridge. The vertical stepped rectangle above is the shears that house the periscopes and radio mast. The rest of the aft fairwater bulwark curves gracefully downward for a short distance directly aft of the shears, then heads aft in a level fashion for quite a distance, then straight down to the main deck. The fairwater aft of the shears actually covered two decks. The lower one housed the large main air induction valve, which allowed the prodigious amounts of air that was used by the diesels to be sucked into the engine rooms. Just aft of the hull number is a rectangular cutout that allowed access to this lower fairwater deck. On the aft end of the conning tower was a watertight door that opened into this void area between the conning tower and the main induction valve. In a battle surface action, the deck gun crew would exit the interior of the boat through this watertight door; walk through the cutout in the fairwater and onto the main deck. They would then head aft to the normal position of the 3"/50 caliber deck gun (not yet mounted when this photo was taken). The upper deck started just above this cutout, with the fairwater bulwark providing roughly a chest high safety rail. This area was known as the cigarette deck, as it was the area that crewmen could go to catch a smoke while the boat was surfaced. Mounted here but often obscured by the fairwater rail was a mount for a Browning M2 .50 caliber water-cooled machine gun. The gun itself was dismantled and taken below before diving, leaving only the hook-shaped mount topside.

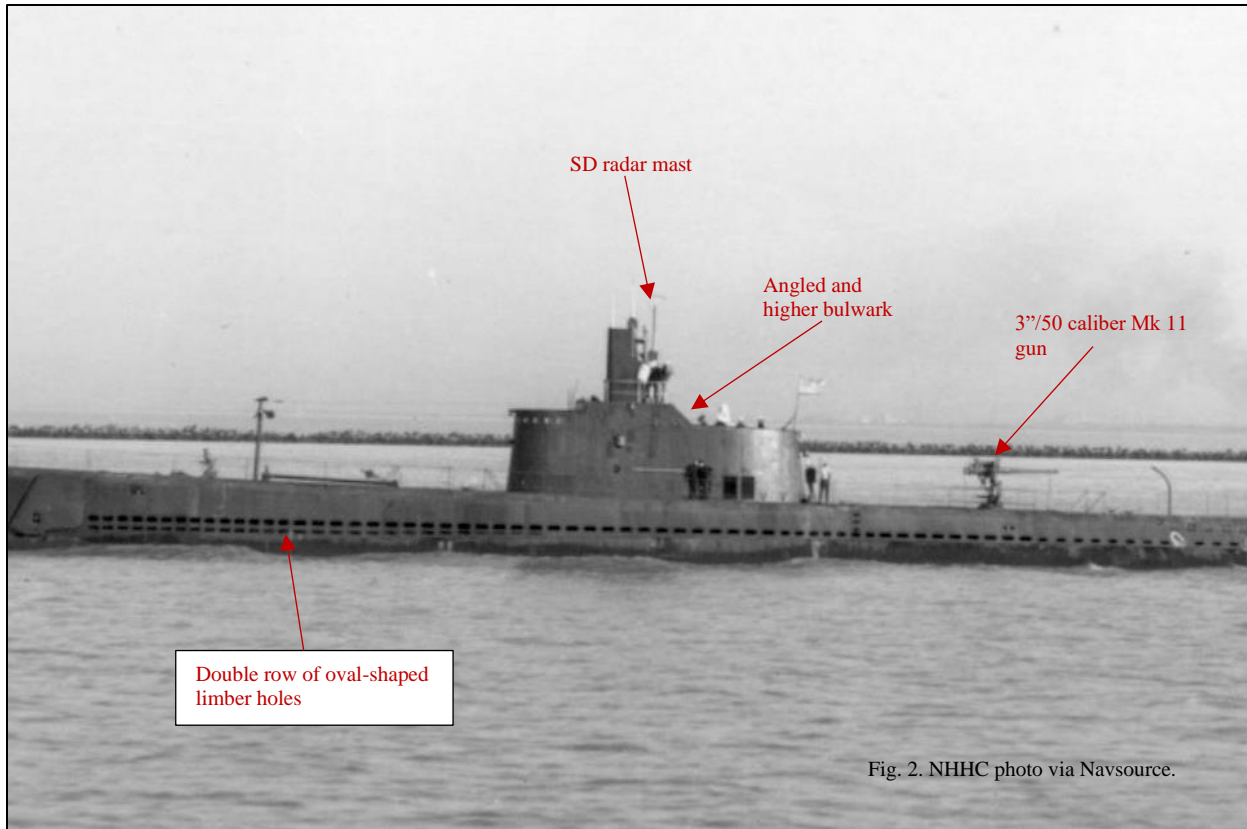
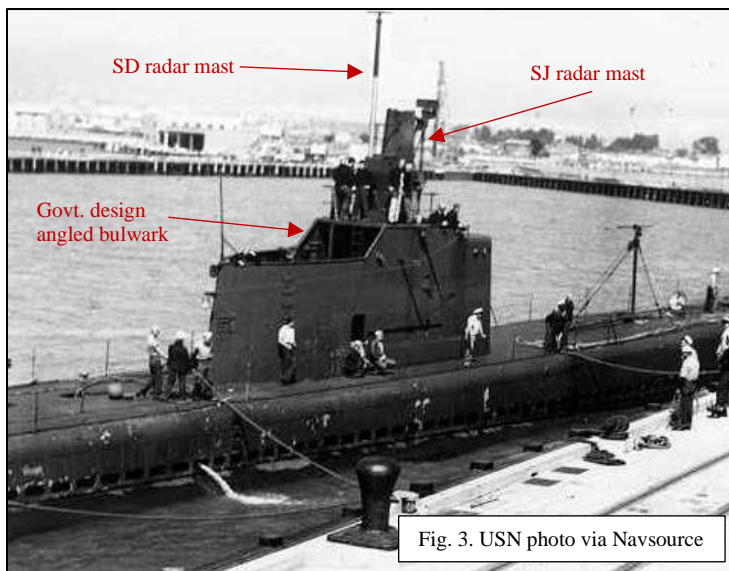


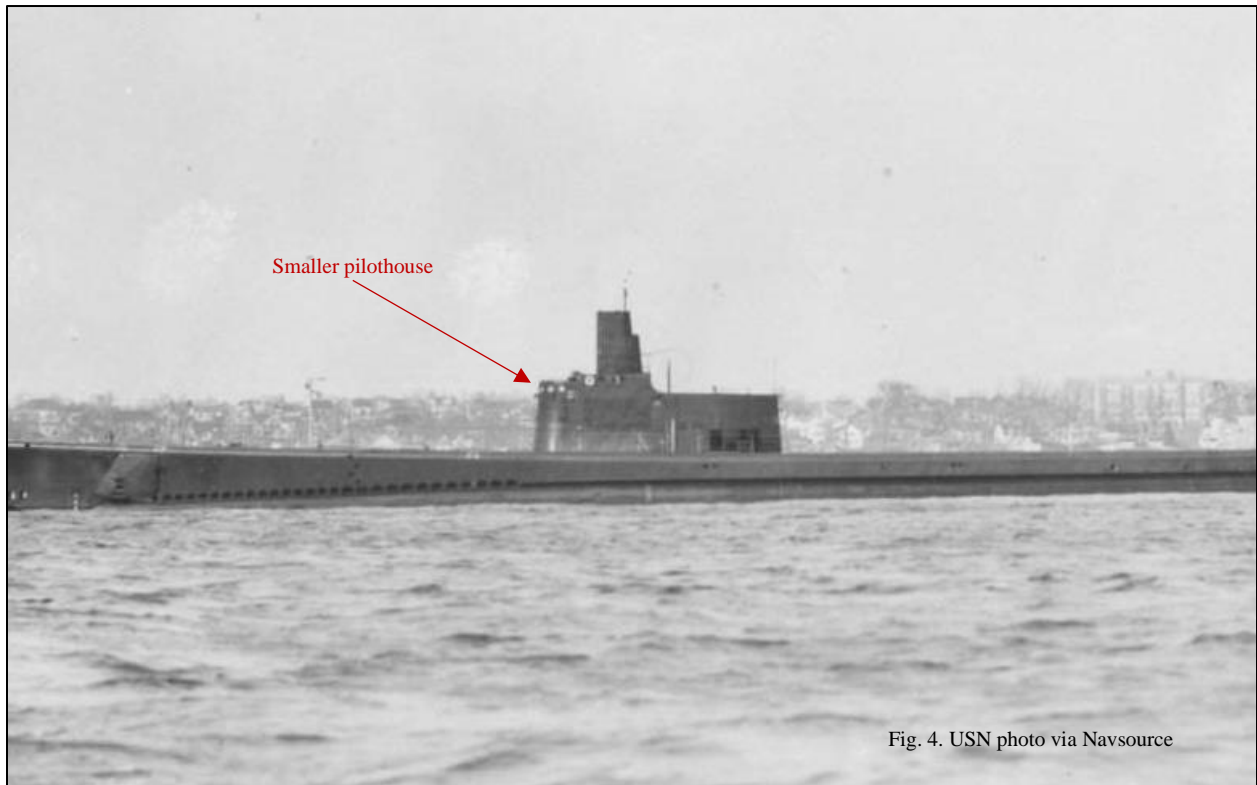
Figure 2 is *Silversides*, the photo taken on 02 February 1942 and is indicative of the Mod 1 Government design. Note how the lookout platform around the shears is extended aft, providing an extra perch. The cigarette deck bulwark rail angles downward from the shears at about a 45-degree angle, as opposed to curving down on the EB design. Notice also that the fairwater aft of the shears is shorter and slightly taller than the EB model and that the trailing edge is at a slight angle as opposed to the vertical edge of the EB design. The Government design used oval-shaped limber holes in the superstructure. One of the first changes made to the boats during the war was the addition of the SD series air search radar. The antenna mast was added to the shears and extended upward from the step perch just aft of the periscopes.



Wahoo is shown in Figure 3 on 01 August 1942, showing her radar arrangement. The T-shaped antenna for the SD is shown on its mast aft of the periscopes. In the late spring of 1942 the SJ series surface search radar began to be installed on the boats and its normal position was on a mast forward of the shears, extending down through the bridge and into the conning tower. Angle brackets fixed the mast to the forward edge of the shears. An SJ set on a Mod 1 boat was actually pretty rare, as most of the boats received the Mod 2 prior to getting their first SJ.

MOD 1A

Starting with *Guardfish*, EB shortened the forward to aft length of the covered pilothouse on their boats. This change was incorporated into production several months prior to the war starting so it may have been economically driven, rather than by operational feedback from the fleet. Compare Figure 4 below of *Guardfish* with that of *Growler* in Figure 1 above and the difference becomes readily apparent. Shortening the pilothouse also eliminated several of the round portholes that were used by the helmsman. This is the Mod 1A. Manitowoc incorporated this change in their very first boat, with construction of *Peto* starting ten weeks after that of *Guardfish*.



Portsmouth and Mare Island did not shorten the pilothouse on the first production run of their boats (*Drum* to *Shad* and *Silversides* to *Whale*). However, starting with the 2nd production run (*Runner* to *Steelhead* and *Sunfish* to *Tunny*) the government yards incorporated a similar Mod 1A to their fairwaters, although it does not appear that they shortened them as much as EB.

MOD 2

The high silhouette of the Mod 1 and 1A fairwaters was increasingly seen as a liability in early 1942 and the desire to reduce the boat's visual profile was foremost in the mind of the submarine crews. Approved by the General Board and authorized by the Bureau of Ships on 09 March 1942, the fairwater bulwark around the cigarette deck was removed. Stanchions and wire safety cables replaced it. This also gave the .50 caliber water-cooled M2 machine gun mounted here a better arc of fire against low-lying targets. This was a relatively easy modification and could be done by a tender in theater. However, it was also incorporated into boats still under construction. Manitowoc starting launching boats with a Mod 2 starting with *Pompon* and Mare Island completed their last two boats (*Tinosa* and *Tullibee*) with this modification. Portsmouth launched all of their boats with

Mod 1 or 1A's and EB transitioned directly to the Mod 3 starting with *Bluefish* (Manitowoc transitioned to the Mod 3 starting with *Raton*).

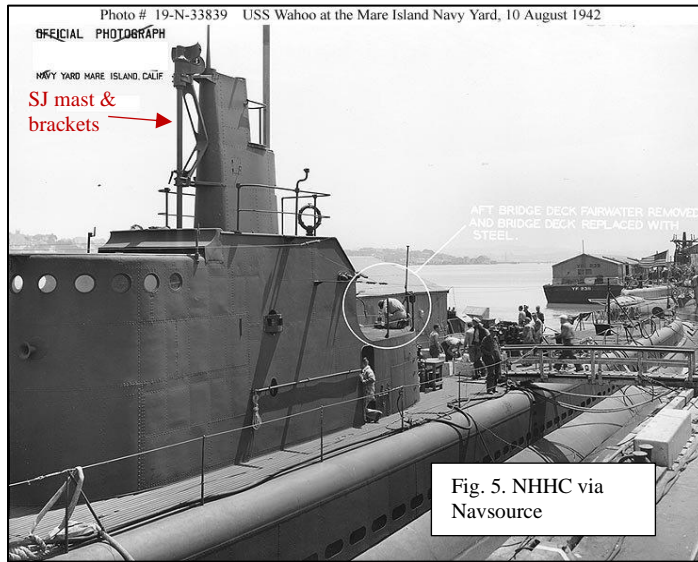


Fig. 5. NHHc via Navsource

Figures 5 & 6 show *Wahoo* at Mare Island on 10 August 1942. These are excellent shots of the early Mod 2 configuration. The periscope shears retained the plating and the SJ mast mounts are clearly visible. The cut down started right where the down angled part of the bridge fairwater ended. On the EB boats this part would have been curved. The existing callouts in the photos highlight the changes.

MOD 2A

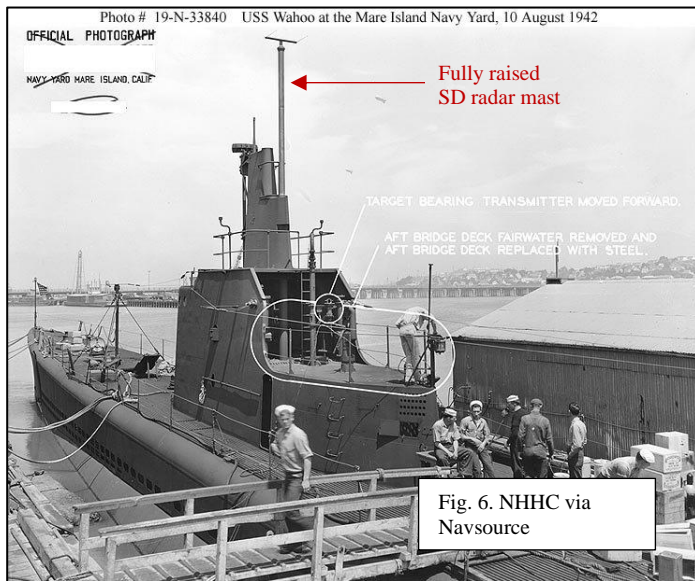


Fig. 6. NHHc via Navsource

As 1942 wore on, a further attempt was made to lessen the silhouette. It was the simple expedient of removing the plating around the periscope shears, giving them a skeletal look. The General Board approved this change on 26 September 1942. Figure 7 below shows *Pogy* on builder's trials on Lake Michigan in the fall of 1942 with the shears un-plated. *Pogy* is an interesting boat in that she went through four major fairwater modifications during her lifetime. She was launched by Manitowoc Shipbuilding (a follow-on yard that built boats to EB plans) on 23 June 1942 with a Mod 1A fairwater. During her fitting

out phase she was converted to a Mod 2A and ran sea trials in this configuration. Prior to commissioning, she was converted to a Mod 3 and in 1944 she received a Mod 4 (see below).

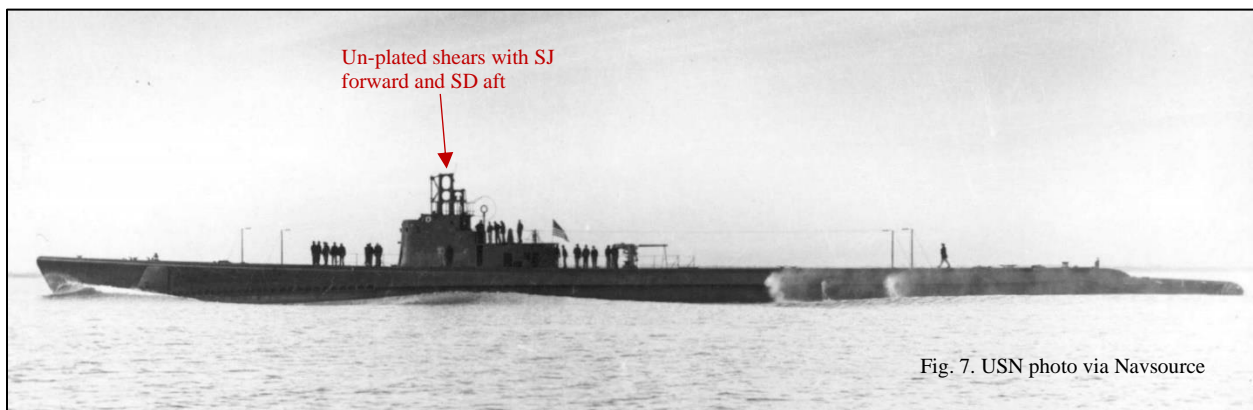
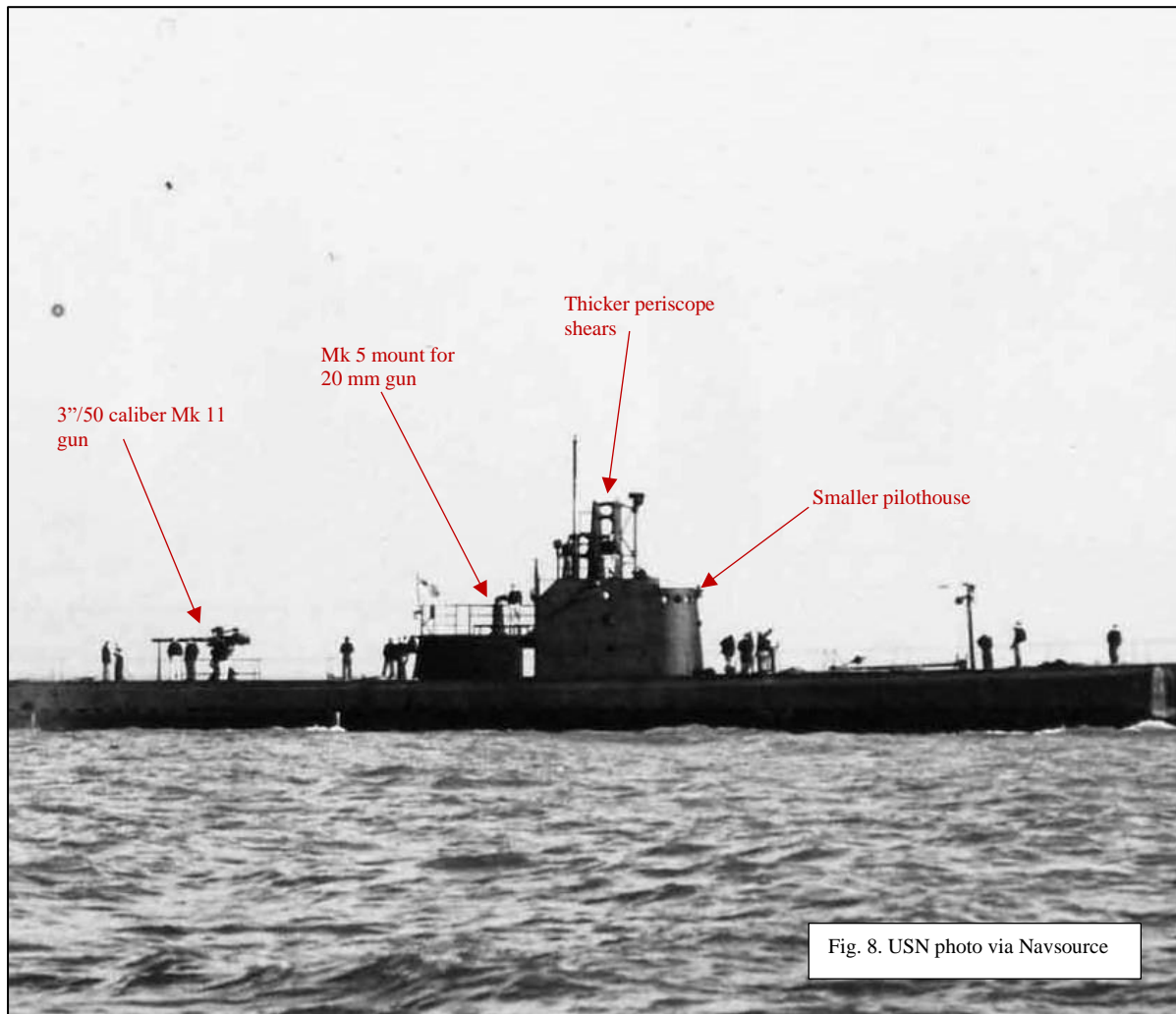


Fig. 7. USN photo via Navsource

Figure 8 below is of a Mod 2A *Tunny* on 06 November 1942 and shows a variation given to some of the *Gatos*. The plating on the shears provided a smooth hydrodynamic flow around the

periscopes, but it also added a level of structural stiffening. Once the plating was removed reports came in of vibration of the scopes at certain speeds and sea states, blurring the eyepiece image. An attempt was made to beef up the shears to eliminate this vibration, although it doesn't appear to have been applied to all of the *Gatos*, as some of them finished the war without this change. For reference purposes, I refer to this as the "thick scope" with the other as the "thin scope" This photo also shows one of the earliest mounts for a 20 mm AA gun on the cigarette deck, replacing the .50 caliber. The Mk 5 mount had a heavy enclosed base that proved to be a bit cumbersome. It was eventually replaced by the lighter, tripod style Mk 10 mount. In both this and the *Pogy* photo the radar installations forward and aft of the periscope shears can be clearly seen. Note also that *Tunny* started life with the shorter pilothouse of a Mod 1A.



MOD 3

The next major step involved the removal of the fairing around the pilothouse and the former surface steering station. Although authorized for removal at the same time as the cigarette deck portion, it seems that this cut down was not done on a widespread basis until late 1942. New construction boats began to slide down the ways in early 1943 with this fairing already cut away. The reason for this delay is not clear, but it may have had to do with the desire to retain the sheltered pilothouse for rough weather surface operations. The desire to reduce the silhouette prevailed though, and once the mod was done, the advantage was obvious. This mod also created a perfect spot for another AA gun and a 20 mm gun mount was usually placed here.

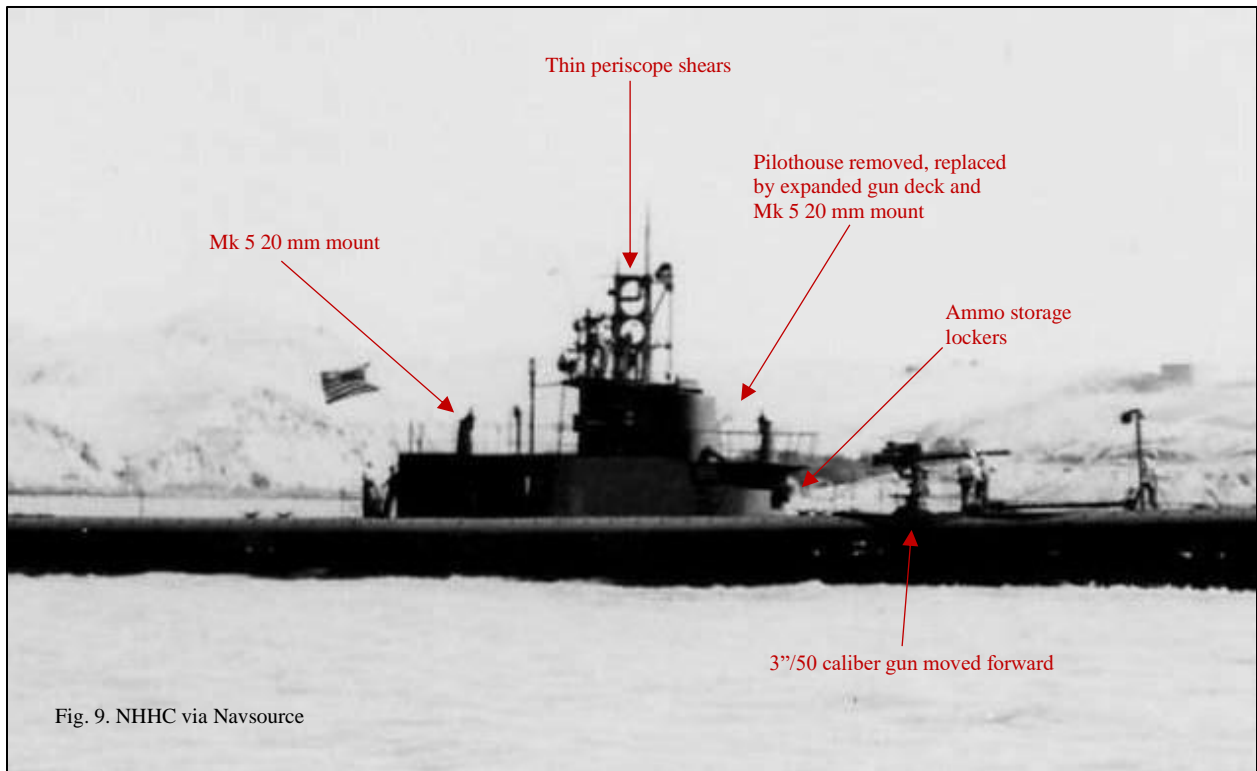
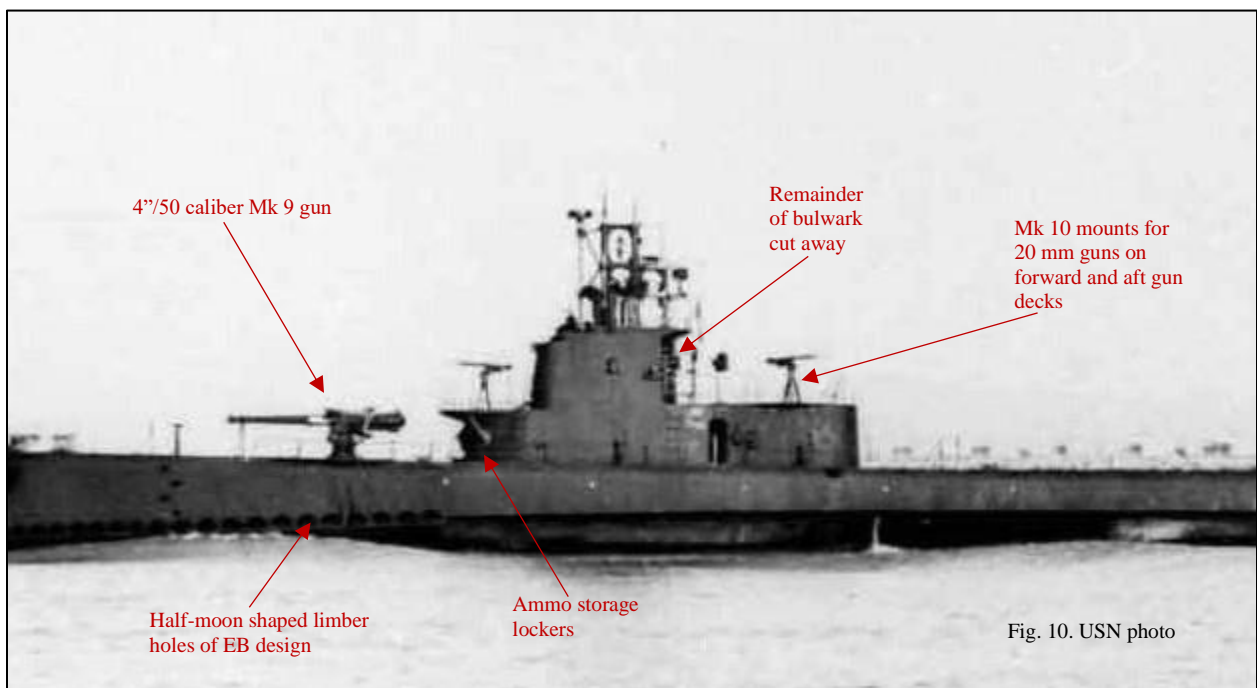
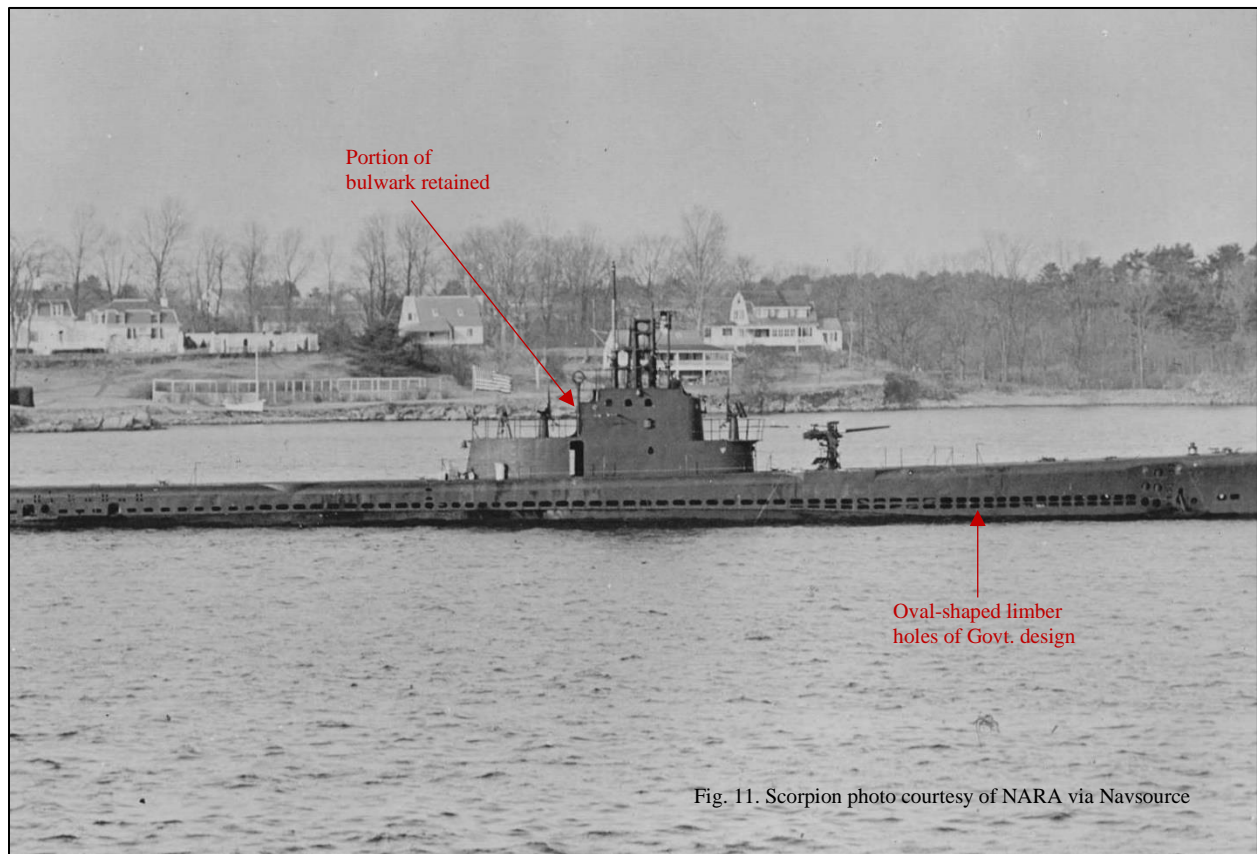


Figure 9 shows the lead boat *Gato* on 06 August 1943 and illustrates an early Mod 3 configuration. At this point in her service, *Gato* still had the thin scopes and the Mk 5 solid mounts for the 20 mm guns. Corresponding with the Mod 3 changes, the deck gun was moved to the forward position. This provided some tactical advantages as you could fire at the target while approaching, as opposed to swinging broadside or moving away to bring the gun to bear. At the time that this shift was made, large numbers of the more powerful 4-inch/50 caliber Mk 9 guns became available and these were quickly fitted onto the boats. These guns came mostly from decommissioned S-boats and their popularity amongst the boat crews did lead to some short-term shortages, as evidenced by the fact that *Gato* is still carrying the 3-inch/50 caliber Mk 11 gun in this photo. It was actually somewhat rare to see this particular gun in the forward spot.

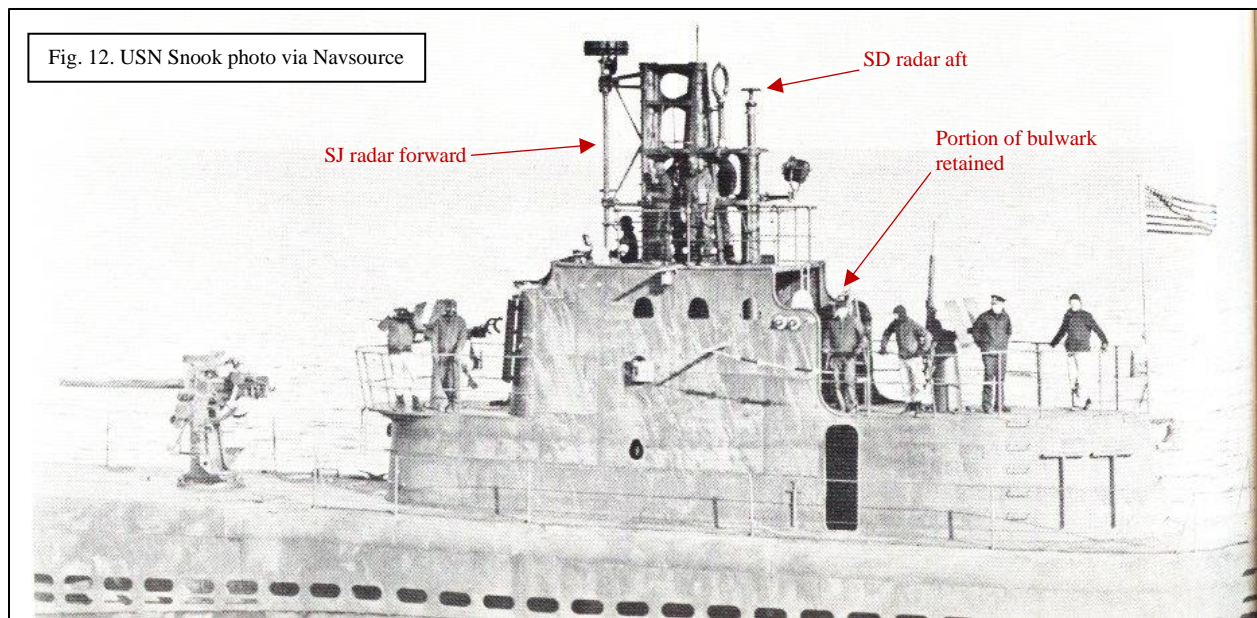


The 17 December 1943 shot of *Jack* above (Figure 10) illustrates the classic Mod 3. With the ammo magazine located under the galley and crews mess aft of the control room, the long passing chain needed to get ammo up to the gun in the forward spot resulted in lower than desired firing rates. To alleviate this, watertight ready service ammo lockers were placed in the fairwater under the forward gun platform and these are visible in both of these photos. *Jack* also sports the lighter Mk. 10 tripod style 20 mm gun mounts. Note also how the fairwater has been cut away directly under the SD radar mast, leaving a short extension for an aft lookout platform and giving the visual impression of a shortened bridge. Compare to photos below.

A variation on the Mod 3 is what I call the Mod 3 Long Bridge (Figures 11 & 12). At least six boats (*Grouper*, *Albacore*, *Herring*, *Scamp*, *Scorpion*, and *Snook*) retained the aft portion of the cigarette deck bulwark underneath the SD mast, a portion that was cut away in the traditional Mod 3.



Some of these boats (those built at Portsmouth) were laid down as Mod 2A's and were modified during construction with the Mod 3 Long Bridge. *Albacore* had her Mod 2A cut down to a Mod 3 Long Bridge in theater, alongside the tender *Fulton* in Brisbane, Australia in May-June 1943. In some cases the extended portion was cut away once the boat arrived in theater or in subsequent overhauls, resulting in a traditional Mod 3. *Snook* underwent further modifications prior to her loss, receiving a Mod 4 at Hunter's Point during overhaul in May 1944.



MOD 3A

As mentioned earlier, the conning tower itself was a horizontal cylinder situated above and separate from the control room and the rest of the pressure hull. The hemispherical ends were dished inward and the after end had a watertight access door for the gun crew. This door proved to be a liability as several boats had them unseated during a depth charge attack, with one boat very nearly being lost. Also, the move of the gun to the forward position resulted in this door becoming redundant. In the spring of 1943 a change was initiated that eliminated this door entirely on the boats under construction, replacing the concave aft end with a new outward dished convex one. This had the welcomed side effect of increasing the available room in the crowded conning tower. This major change to the structure of the conning tower was also applied to some of the commissioned boats, but had to be accomplished during overhaul at a major shipyard. The side effect of increased room in the conning tower was short lived, however as now the gun crew had to come up through the conning tower and cross the bridge to reach the deck gun, necessitating a carefully orchestrated ballet during a battle surface scenario. This problem was rectified in the *Balao* and *Tench* classes with the addition of a gun access trunk that bypassed the conning tower and allowed direct access to the main deck forward from the control room.

The crowding of the conning tower led to other changes. The SD radar mast was moved aft and out of the conning tower altogether, with a new mast for it installed on the cigarette deck. This allowed the SJ radar mast to be moved to a more optimal position aft of the shears, getting it out of the way on the bridge. This created the Mod 3A (Figures 13 & 14), with this mod first appearing in late 1944. The 28 May 1945 photo of *Pargo* below shows one of the many variations of gun armament with the new and much more powerful 5-inch/25 caliber gun in the forward position (unusual, the 5-incher was usually sited aft), a 40 mm single mount on the forward gun deck, and a 20 mm on the cigarette deck.

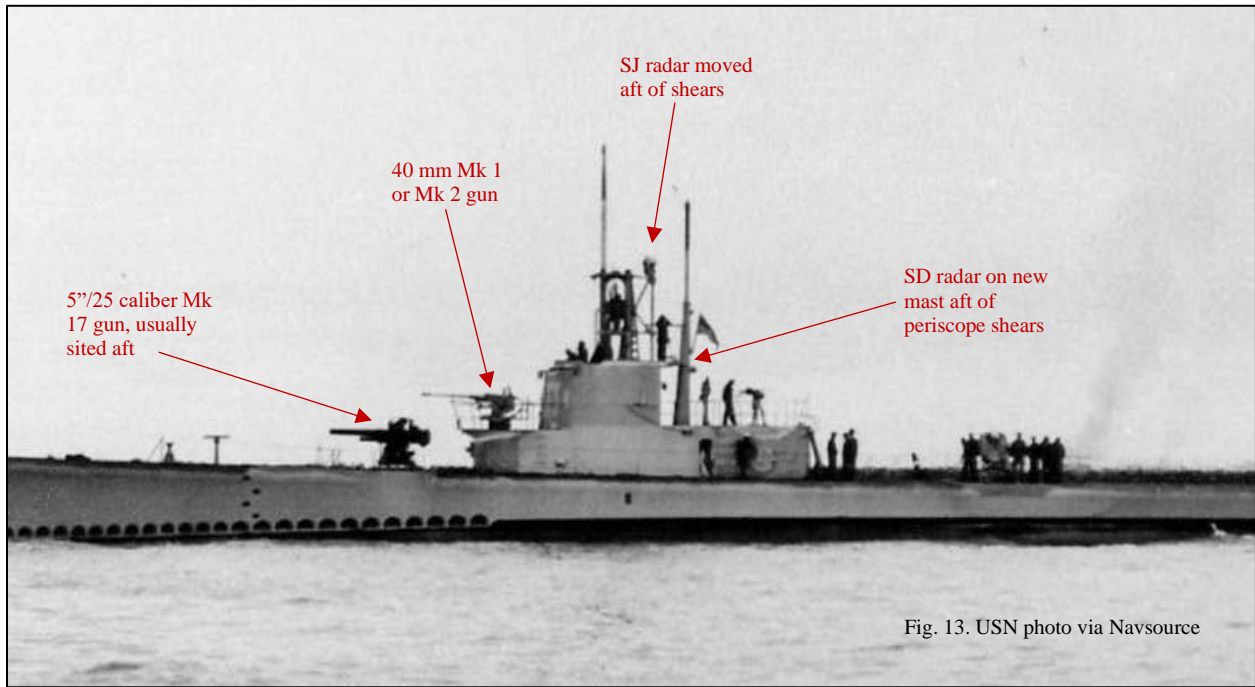
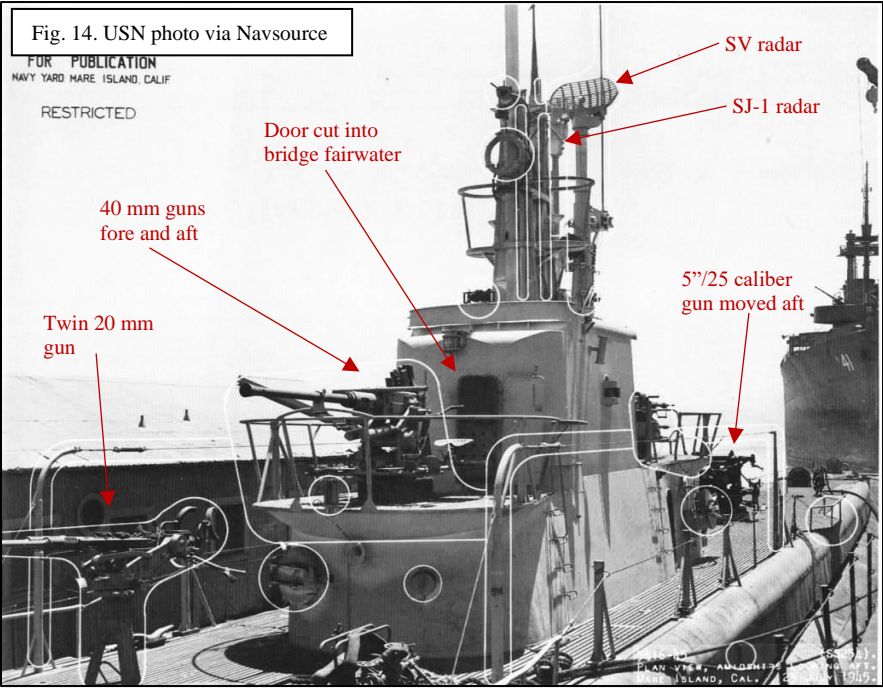


Fig. 13. USN photo via Navsource

Towards the end of the war, the much more capable SV radar with its large wire mesh antenna replaced the SD radar antenna on the same mast. The SJ was upgraded to the SJ-1. Many other detail changes were made as well. Additional ammo lockers, ladders down from the cigarette deck, rearranged lookout perches, and small spindle mounts for .50 caliber machine guns appeared in a bewildering number of arrangements. Note also in this 23 July 1945 photo of *Gurnard* (Figure 14)



that she has been up gunned with the addition of 40 mm single mounts on the forward and cigarette deck mounts and a twin 20 mm mount on the forward main deck position, with the 5-inch/25 sited aft. One other minor mod common at this time was the addition of a non-watertight door through the bridge fairwater, leading to the forward gun deck. This improved the access to the forward guns. Many of the *Gato* class boats finished the war with a Mod 3A fairwater.

MOD 4

Some personnel were still not happy with the size of the bridge silhouette. One additional effort was undertaken and it was found that the height of the bridge itself could be lowered. Aft of the bridge, three I-beams rose up from the superstructure on each side of the conning tower and curved

inward to provide structural support for the periscope shears. They also provided attachment points for the fairwater plating. These beams could not be removed without compromising the strength of the shears. Besides, they provided excellent lookout platforms. Portions of the plating could simply be removed allowing light to penetrate through. The combination of lowering the bridge and removing this plating resulted in the Mod 4 configuration. Although quite similar to the Mod 3, this configuration developed a little later, not appearing until early 1944.

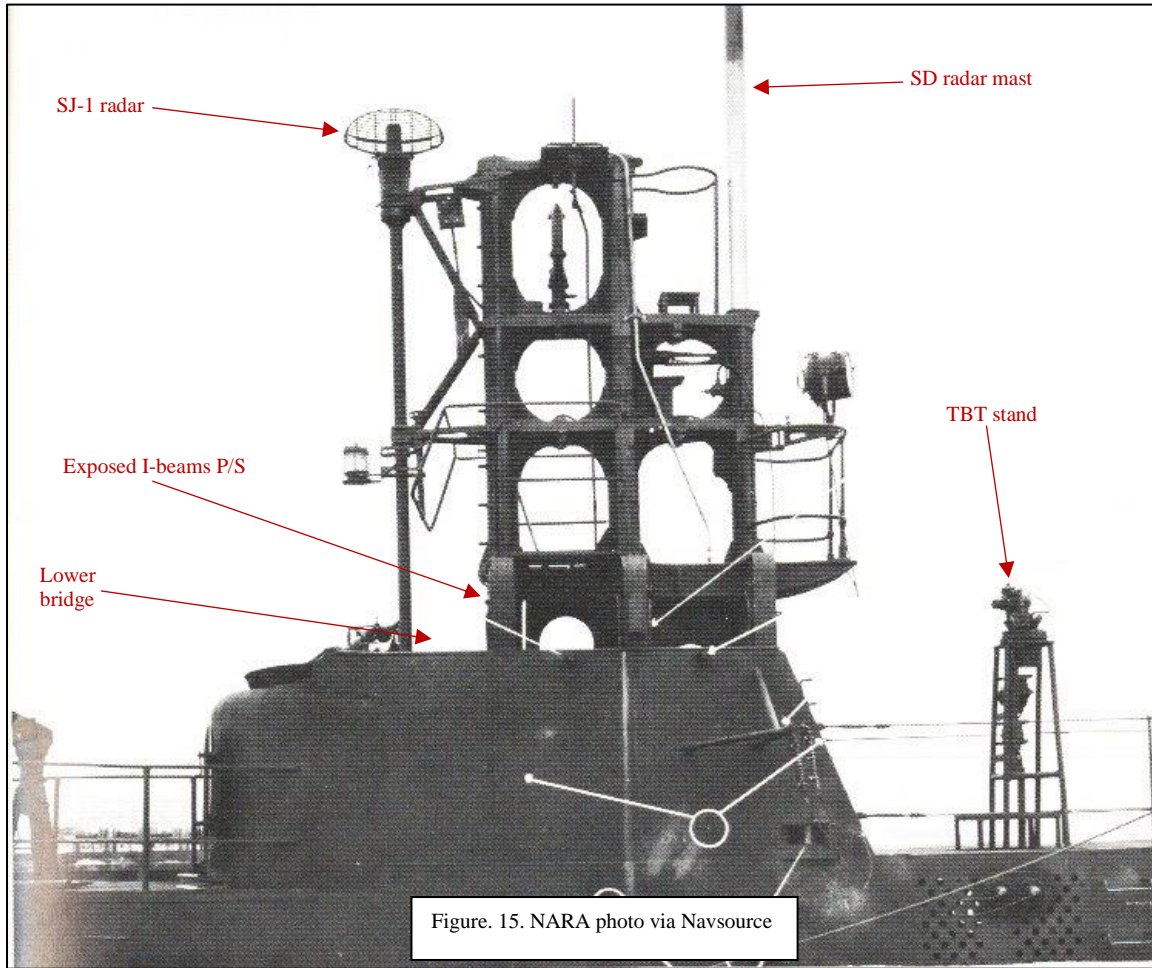
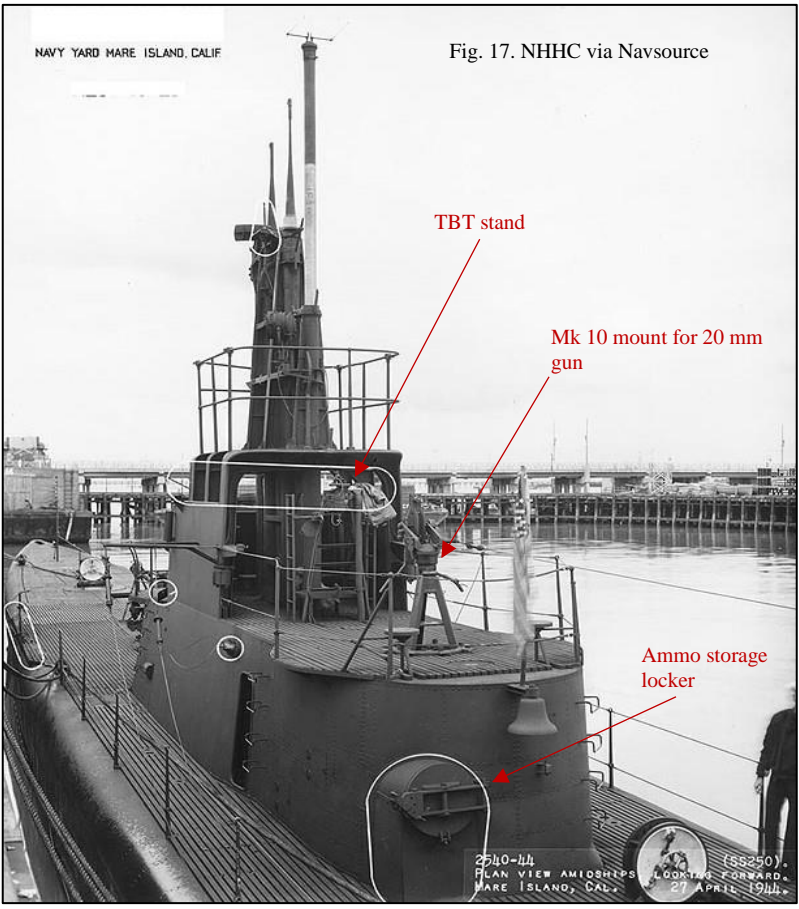
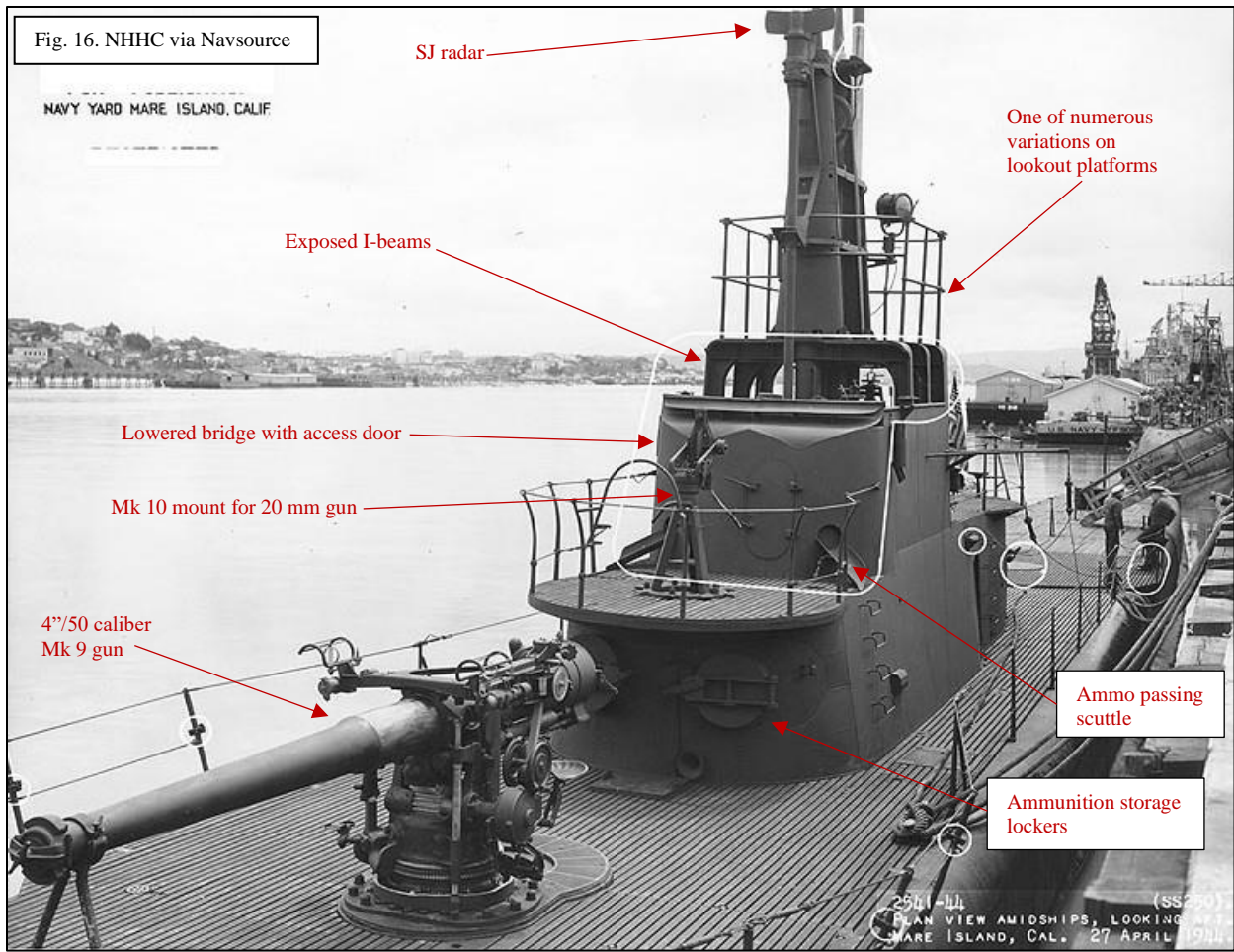


Figure 15 is a shot of the oft-modified *Pogy*, taken in August 1944 showing the typical Mod 4. Note the skeletal look of the thin scopes and the prominent mount for a TBT (Target Bearing Transmitter) on the cigarette deck. The SJ radar mast is still mounted forward (the late war improved SJ-1 with the bigger antenna), and the SD mast immediately aft on the shears, identical to the Mod 3 arrangement. Her RDF loop antenna (used for homing on radio signals) is sited between the periscopes. Removing the fairwater plating and exposing the ribs gave this mod a distinctive look and is what gave rise to the *Gato* class being referred to as the “covered wagon” boats.

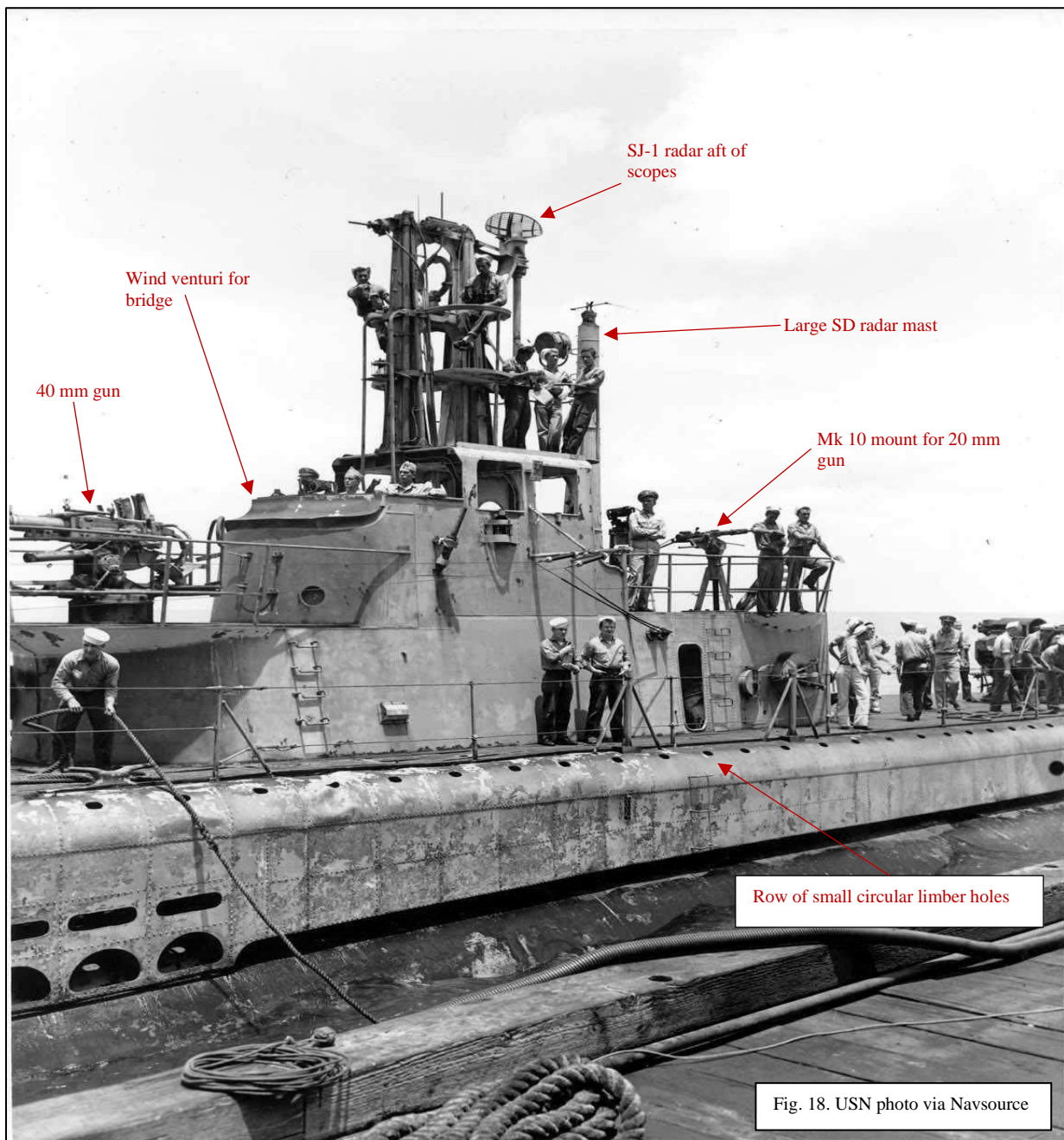
It bears noting that the covered wagon ribs on the fairwater were present *only* in the design of the *Sargo*, *Tambor*/*Gar*, and *Gato* class boats, and this proves to be a key point in identifying submarines of these classes. Due to shorter periscopes, the ribs did not exist on the earlier *Porpoise*/*Perch* and *Salmon* classes, and a total redesign of the fairwater and shears on the later *Balao* and *Tench* class boats did away with them entirely.



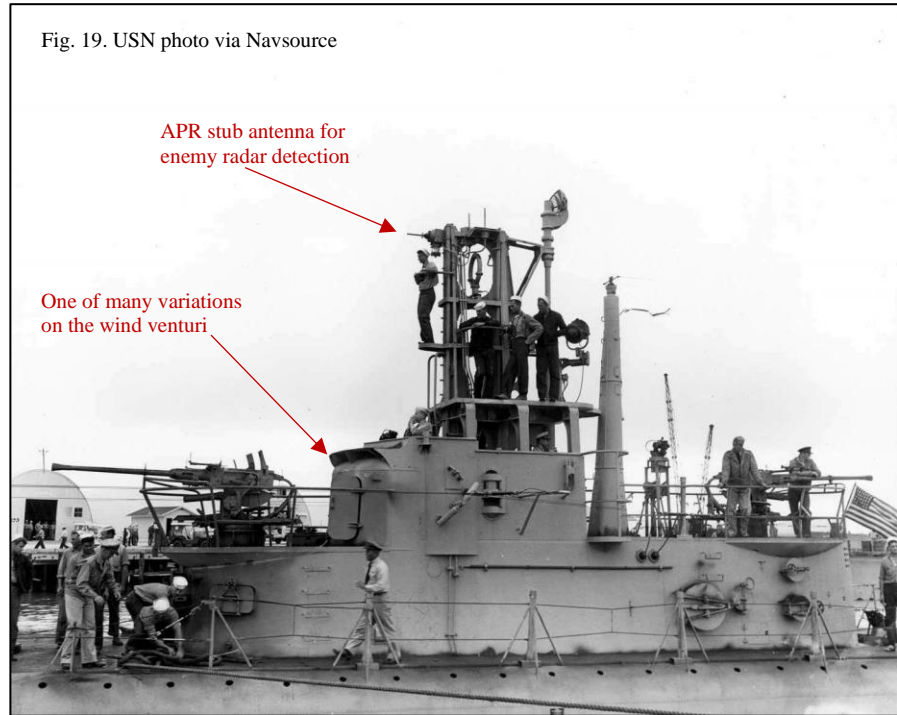
These two 27 April 1944 photos of the ill-fated *Flier* (Figures 16 & 17) are a good representation of a Mod 4. The covered wagon ribs are very prominent. Her gun armament at this time was a 20 mm on a Mk 10 tripod mount on the forward gun deck and cigarette deck, and a 4"/50 caliber Mk 9 gun in the forward main deck position. Two ammunition-passing scuttles have been cut into the bridge fairwater, allowing the quick passing of 4-inch ammunition from the conning tower to the forward gun crew. Note the detail differences in the arrangement of her lookout platforms compared to the *Pogy* photo above. These photos also show *Flier* with the original SJ small dish surface search radar.

MOD 4A

Running virtually concurrent with the Mod 3A, the 4A was very similar in having both radar masts aft of the shears, but with the low bridge and the covered wagon ribs of the Mod 4. This was the last major modification of the *Gato* class fairwaters during the war. The photos of *Cero* and *Dace* (Figures 18 & 19) represent the typical Mod 4A. Both show the late war SJ-1 radar, but neither had received the new SV radar to replace the SD when these photos were taken. The SV was just coming into service when the war ended and availability was limited. Between the thick scopes, the circular RDF antenna loop can be seen. There are numerous minor detail differences between the two boats. The smaller changes were easily done by tenders between patrols and whether they were accomplished was usually left to the preferences of the boat's commanding officer. *Dace* was equipped with two 40 mm guns, one on each fairwater gun deck.



In Figure 19 of the *Dace*, note the difference in the wind venturi along the front edge of the bridge and compare it to many of the preceding photos. The purpose of this device was to channel wind up and over the heads of the bridge crew, improving the comfort of the watchstanders. Having looked at *a lot* of photos during the course of research for this article, I found an amazing variety of modifications for this venturi. There was seemingly no rhyme or reason to the design, reflecting a lot of different ideas on how to mitigate the wind problem. This experimentation with the venturi took place throughout the war and was not specific to any particular *Gato* fairwater modification, or even to the *Gato* class itself.



OTHER VARIATIONS

Along with the major modifications detailed above, there were several one-off and unique mods done to several boats. Some of these may have been short-term interim changes, but a few were permanent.

Gun armament varied quite a bit during the war. Some of the boats finished the war with the 5"/25 caliber Mk 17 gun on the main deck, and there were many variations of the 20 mm and 40 mm installations as seen throughout this chapter. There was a variety of radar detection antennas fitted late in the war, Figure 19 shows the representative APR stub antenna mounted on the front of #1 periscope shear. A small number of boats (*Cero*, *Dace*, *Albacore*, *Scamp*, and a few others) received a row of small limber holes drilled into the upper edge of the superstructure where it rounded over to the main deck (Figures 18 & 19).

Gato is shown in Figure 20 below with a variation of the Mod 1. This 30 August 1942 photo taken in Dutch Harbor shows her periscope shears un-plated. I have yet to see any other boat with a Mod 1 or 1A with this variation. The circular RDF loop is very prominent in its original position on the cigarette deck. It has an anti-fouling framework erected around it. The loop antenna would eventually be moved in most Mods to a position between the periscopes. The object aft of the loop is the water-cooled Browning M2 .50 caliber machine gun. It is covered with a weatherproof canvas covering. This weapon would not have been left mounted topside when the boat submerged. It would have been taken below and was mounted here to provide some level of air defense while the boat was in harbor.

Fig. 20. NARA photo via Navsource

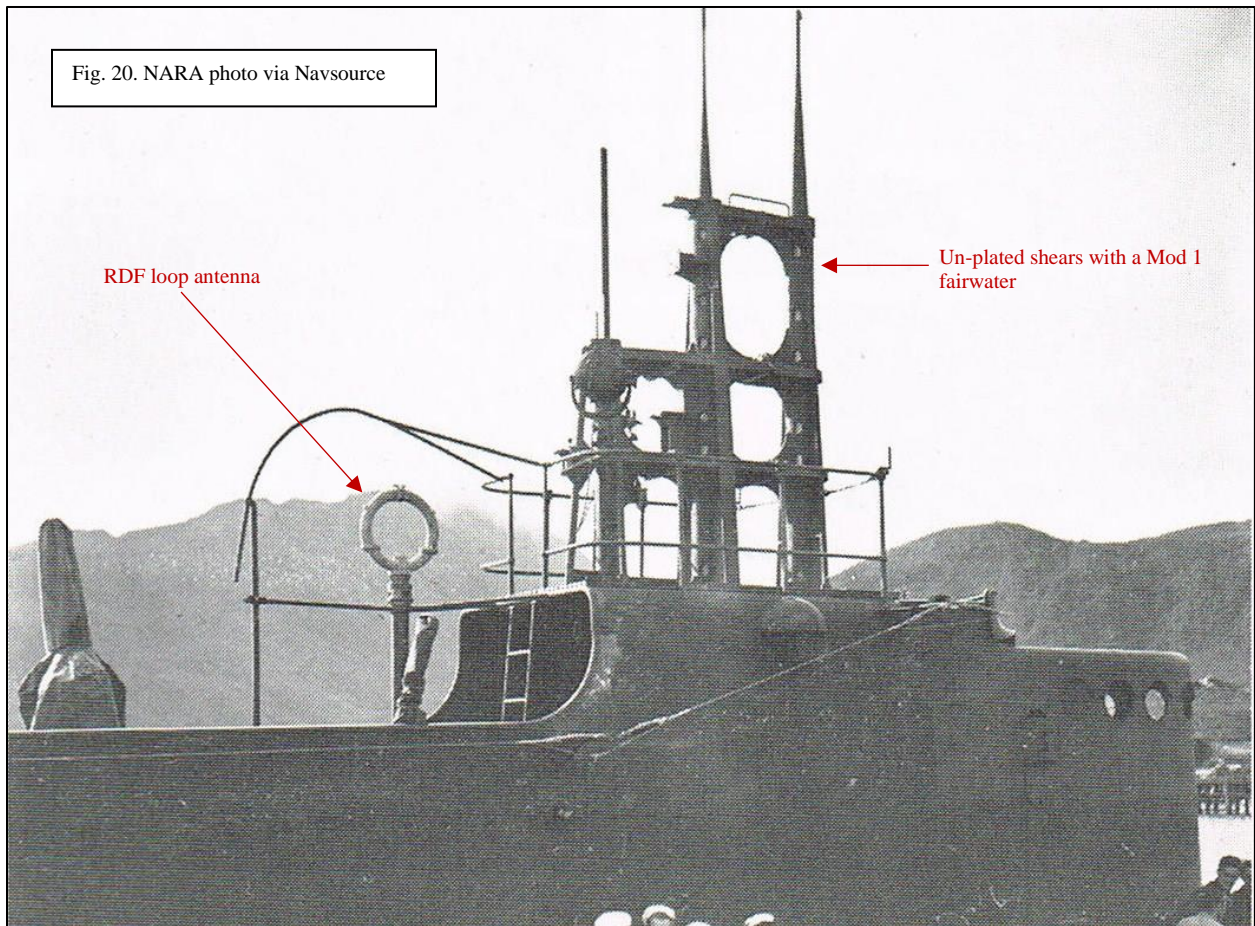


Figure 21 is a bow-on shot of the famous *Harder* following an overhaul at the Mare Island Navy Yard, 19 February 1944. She is the recipient of a unique SJ radar installation. She is sporting a Mod 3 fairwater, but the SJ radar is mounted *aft of the periscope shears*, offset slightly to starboard. As far as can be determined, this variation was unique to *Harder*. In addition, she also has the “thick scope” modification to her periscope shears. In this case both scopes have been partially encased in a gradually tapering cone, wrapping halfway around the tubes. *Flier*, shown in Figures 16 and 17 above, has a similar modification to her scopes.

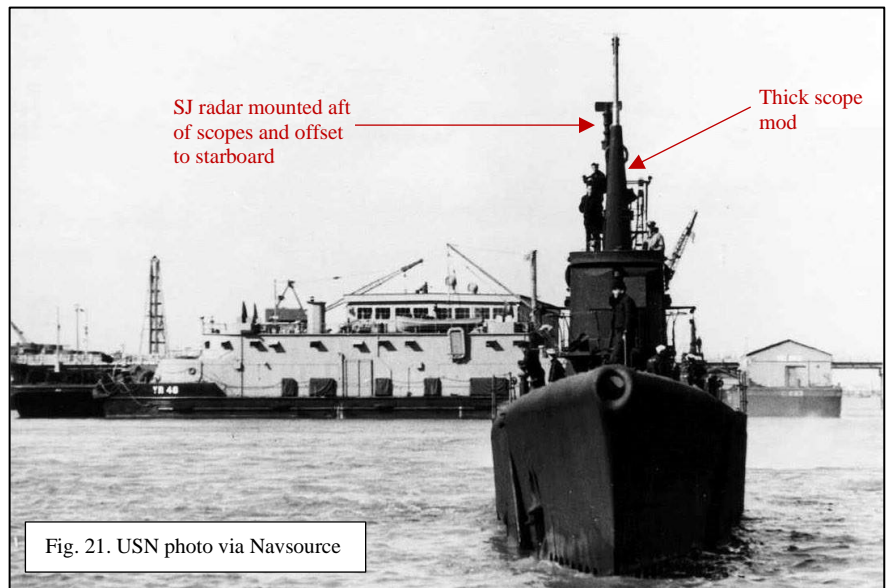


Fig. 21. USN photo via Navsource

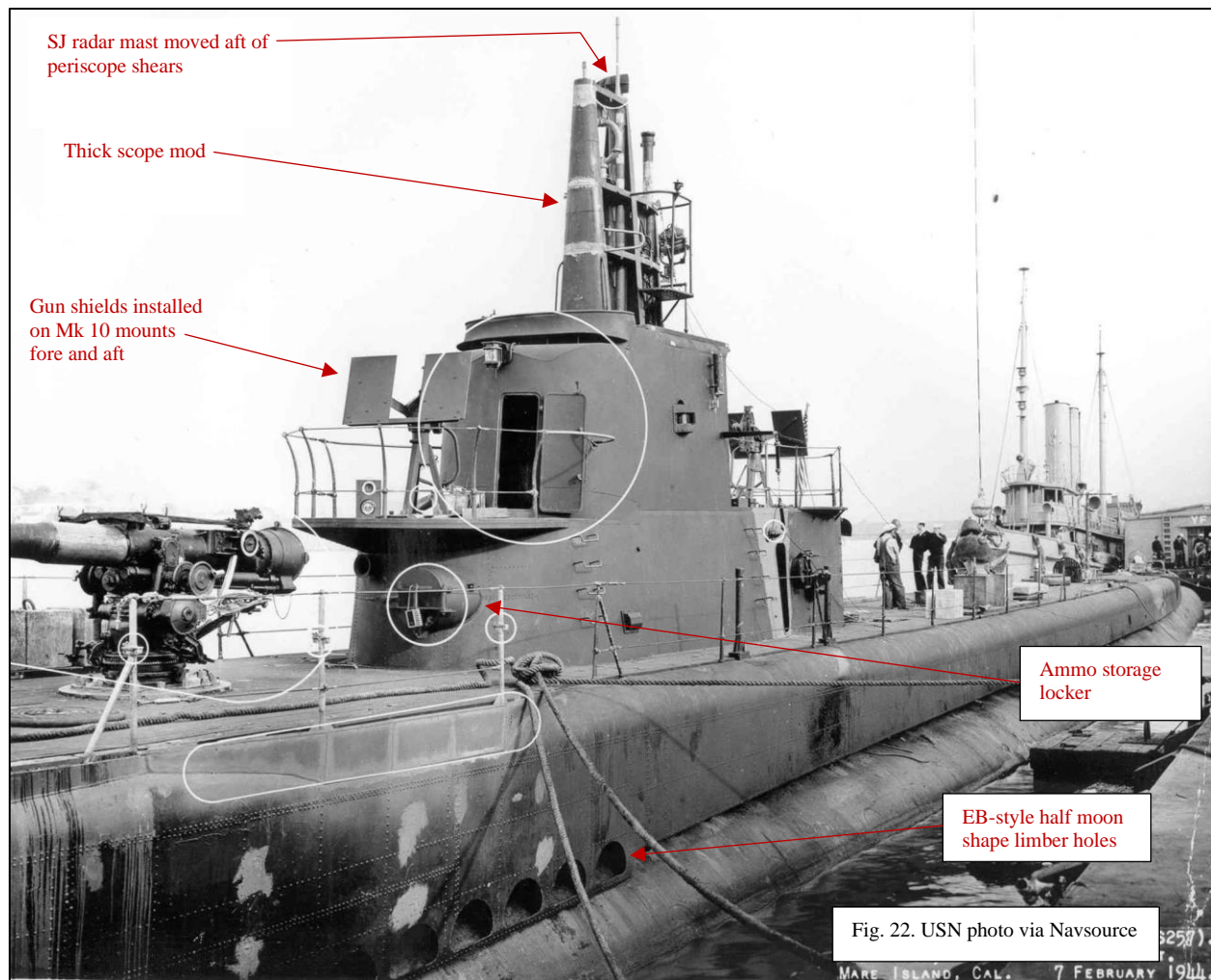
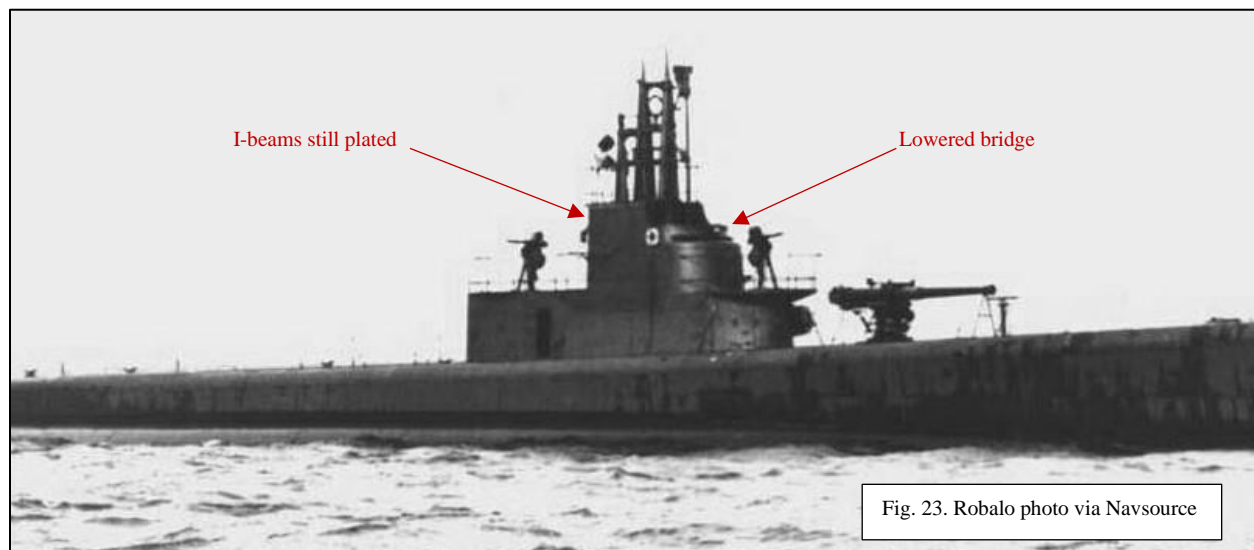
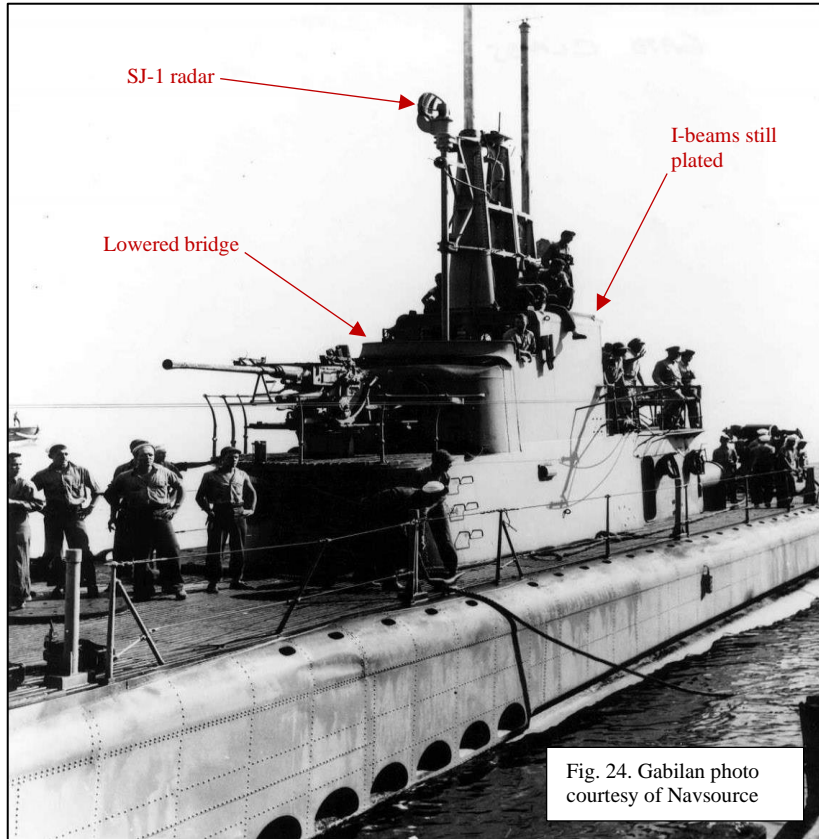


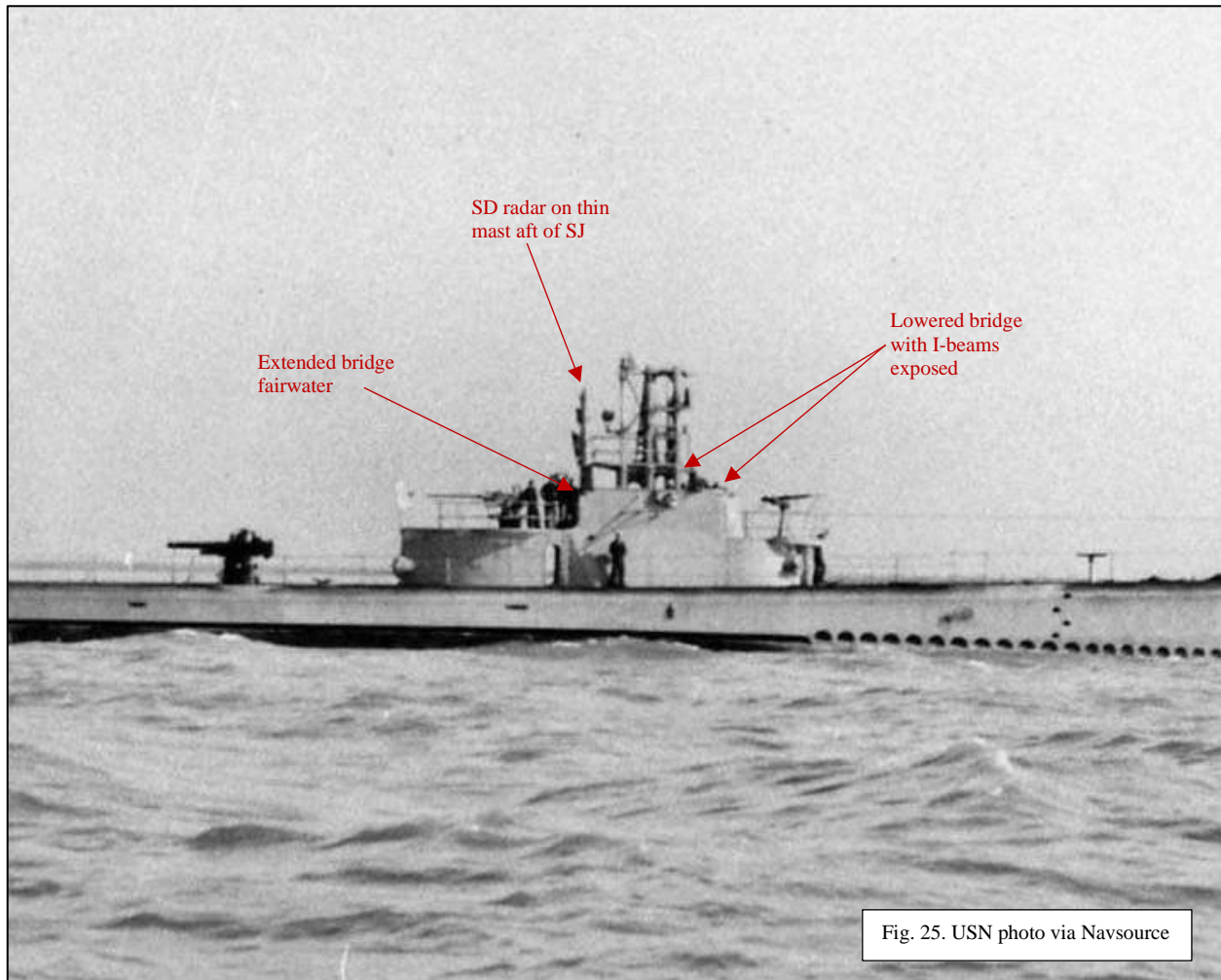
Figure 22 is also of *Harder*, taken at the same time as the photo above. The thick scope mod and the unusual location of the SJ radar mast can be seen. The Mk 10 mounts for the 20 mm guns have rectangular gun shields installed. These shields were not popular with the crews, with many boats later removing them, although it appears that *Harder* retained them for at least one more patrol. Note the access door cut into the bridge fairwater, and the ammunition storage locker underneath the forward gun deck.





Robalo and *Gabilan* (Figures 23 & 24) both sported at one time a Mod 4, but with the covered wagon I-beams still plated. *Robalo* was launched with a Mod 3 but had her bridge cut down to this version before her sea trials began. She carried it for her entire, but short career. *Gabilan* was also launched with a Mod 3 and converted later, but survived the war and can be seen in post war photos still carrying this variation. *Robalo* is sporting the original small dish SJ radar, but *Gabilan* has received the later SJ-1 upgrade by the time this photo was taken.

Greenling is shown in Figures 25 and 26 below in mid-1945 with a Mod 4A, but with a long bridge fairwater and with the



SD radar mounted on a thin mast just aft of the SJ. This is the only boat with a Mod 4 or 4A to have the long bridge variation. She carried this unique fairwater configuration to the end of her life, serving after the war as a Naval Reserve training vessel in Portsmouth, NH and Boston, MA, although she was eventually refitted with a 4"/50 caliber Mk 9 deck gun in the forward position.

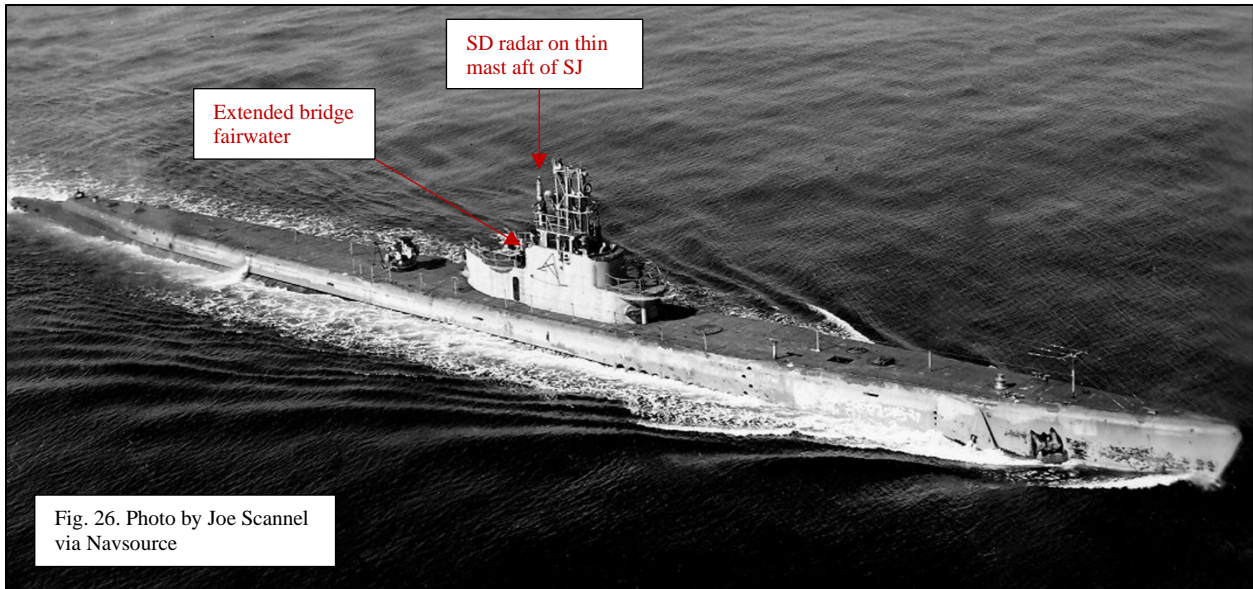
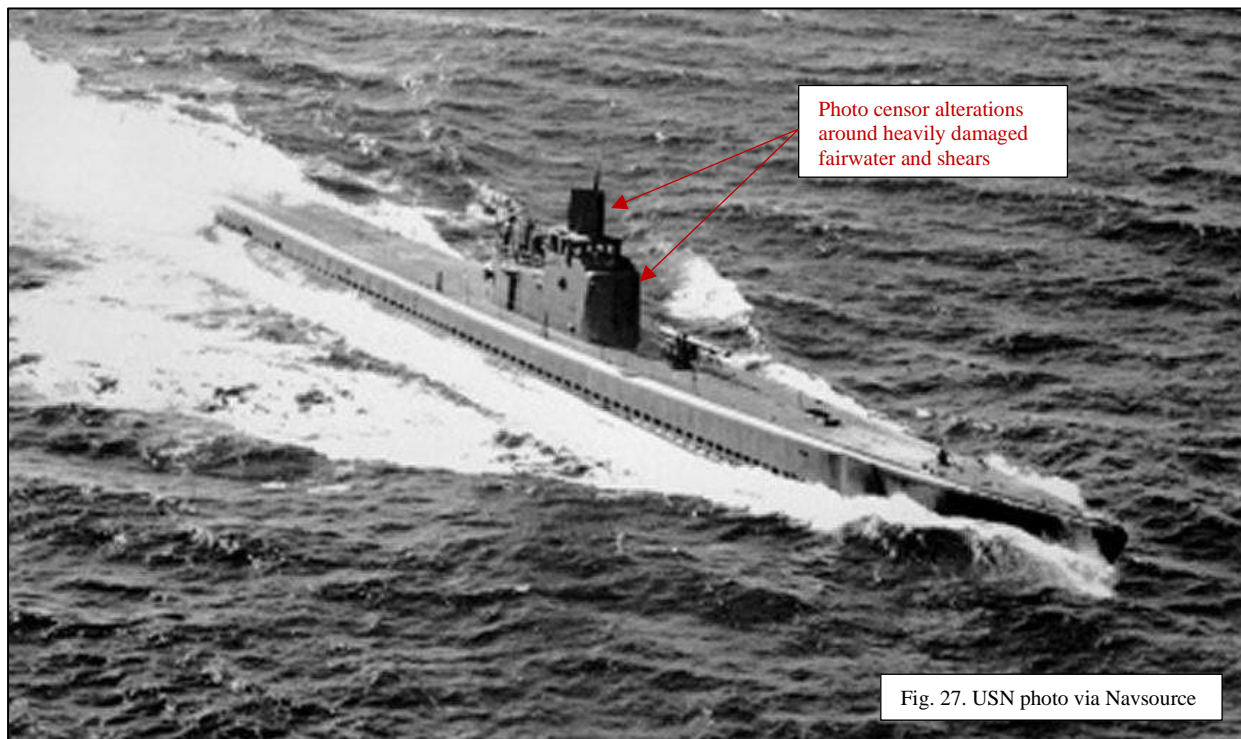


Figure 27 is a photo that has shown up in several publications identified as *Shad* with what would be a very unusual Mod 2 with a cut down bridge. It actually shows the *Halibut*, making her way home to the states after barely surviving a near fatal aircraft-borne depth charge attack on 13 November 1944. Only through heroic efforts by her crew was the terribly damaged *Halibut* able to return safely to port. Examined by engineers at Saipan, Pearl Harbor, and San Francisco she was deemed to be beyond economical repair. Temporarily patched up with her badly damaged fairwater partially rebuilt she sailed from San Francisco on 16 February 1945 for New London. She was decommissioned there on 18 July 1945. The photo has also been altered by a censor.



Never having made another war patrol, she was essentially the 53rd wartime submarine loss. Thankfully her entire crew survived. She is shown in Figure 28, painted black, in the company of several other *Gatos* at the submarine base in New London in an unaltered post-war photo. She is missing the forward fairwater gun deck and most of her masts, and the front edge of the bridge has been rebuilt. By this time all of her guns have been removed.

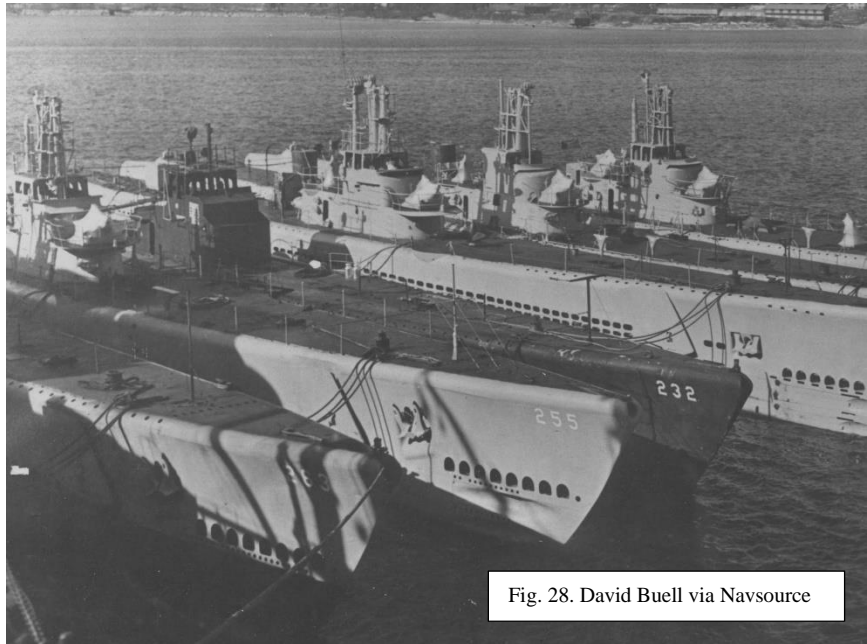


Fig. 28. David Buell via Navsource

Flying Fish and *Steelhead* were unique among the *Gatos*. Both of these boats had complete rebuilds done on the fairwaters during the war. This involved the complete removal of the fairwater and periscope shears (including the distinctive I-beam covered wagon ribs) down to the main deck and the replacement of this structure with one that resembled that of the later *Balao* class. In the case of *Flying Fish*, the reason for this radical, expensive, and time-consuming change is not yet clear. For *Steelhead*, it is known that she had a major fire in the conning tower on 01 October 1944, with the damage being extensive enough to warrant the installation of a new conning tower. The fairwater was rebuilt at this time as well. Figures 29 and 30 show the extent of the rebuild done to *Flying Fish*. She ended the war with two 5"/25 caliber guns.

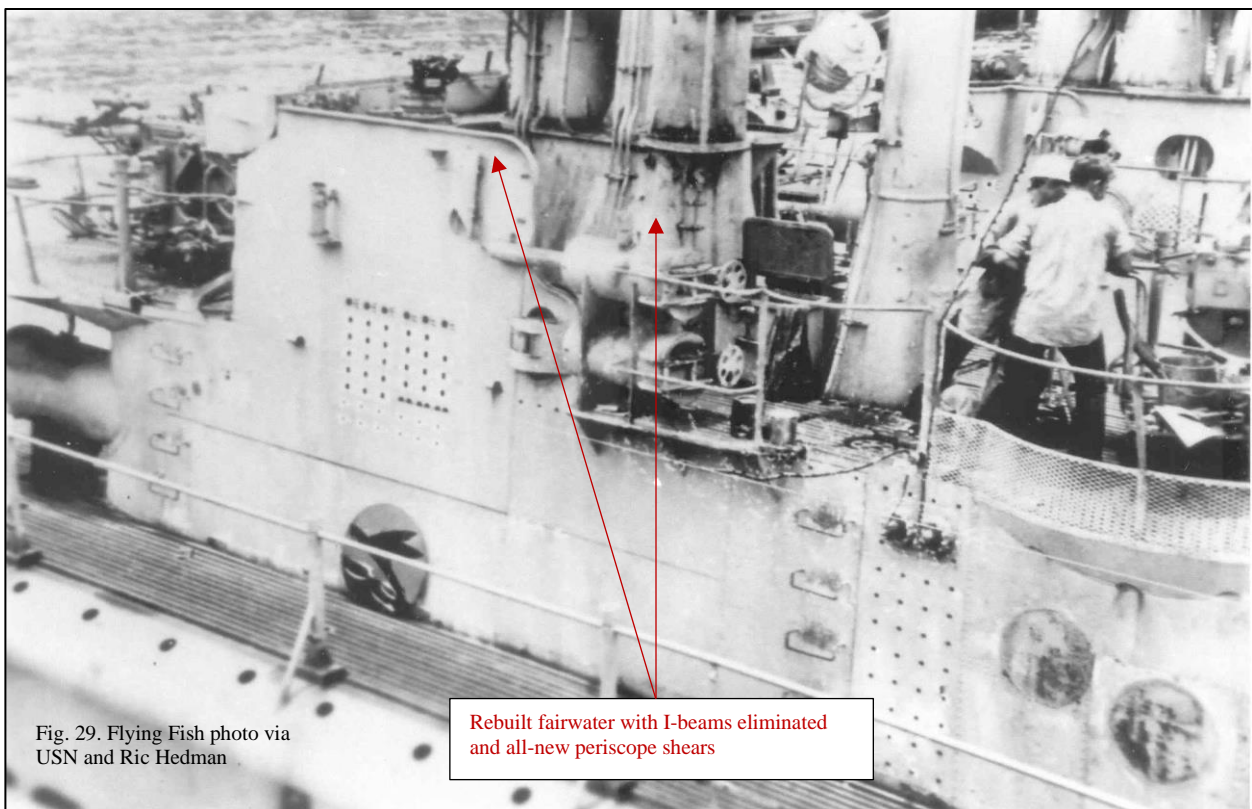
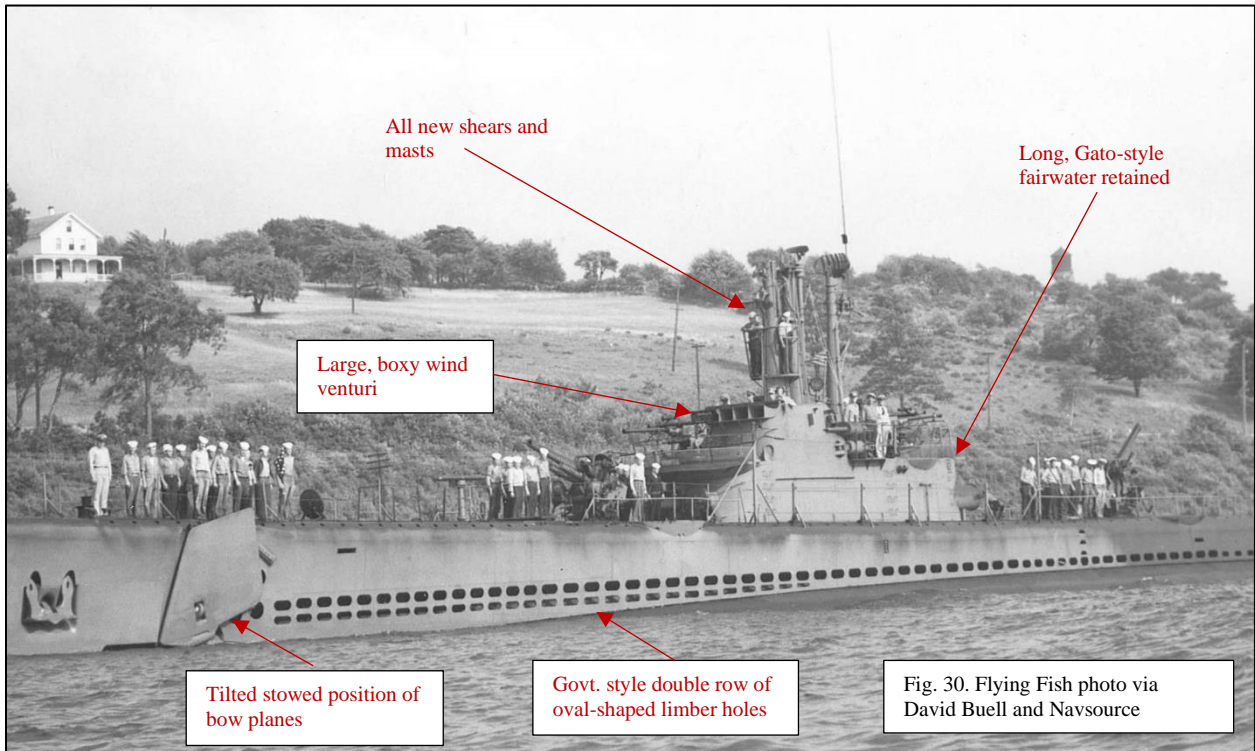
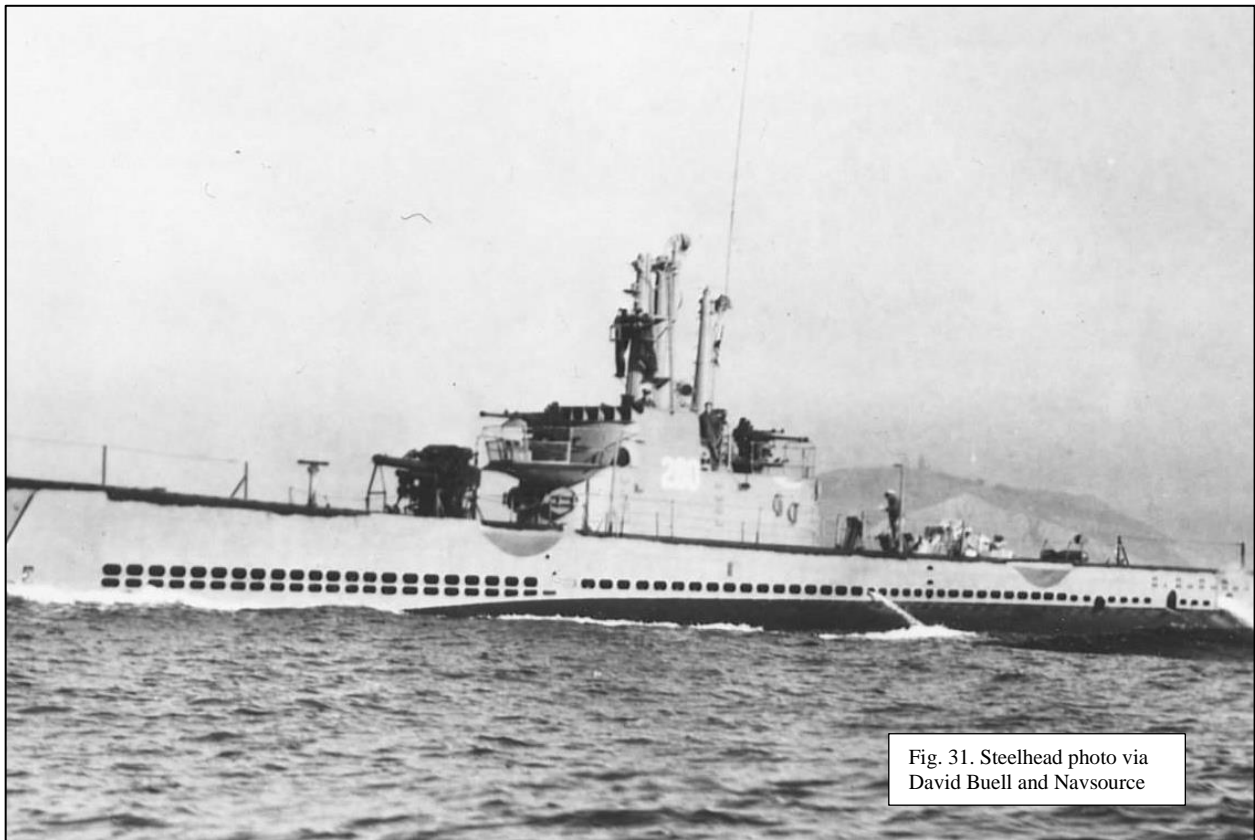


Fig. 29. Flying Fish photo via USN and Ric Hedman

Rebuilt fairwater with I-beams eliminated and all-new periscope shears



Figures 31 and 32 show the extent of the changes to *Steelhead* and illustrate her overall similarity to *Flying Fish*.



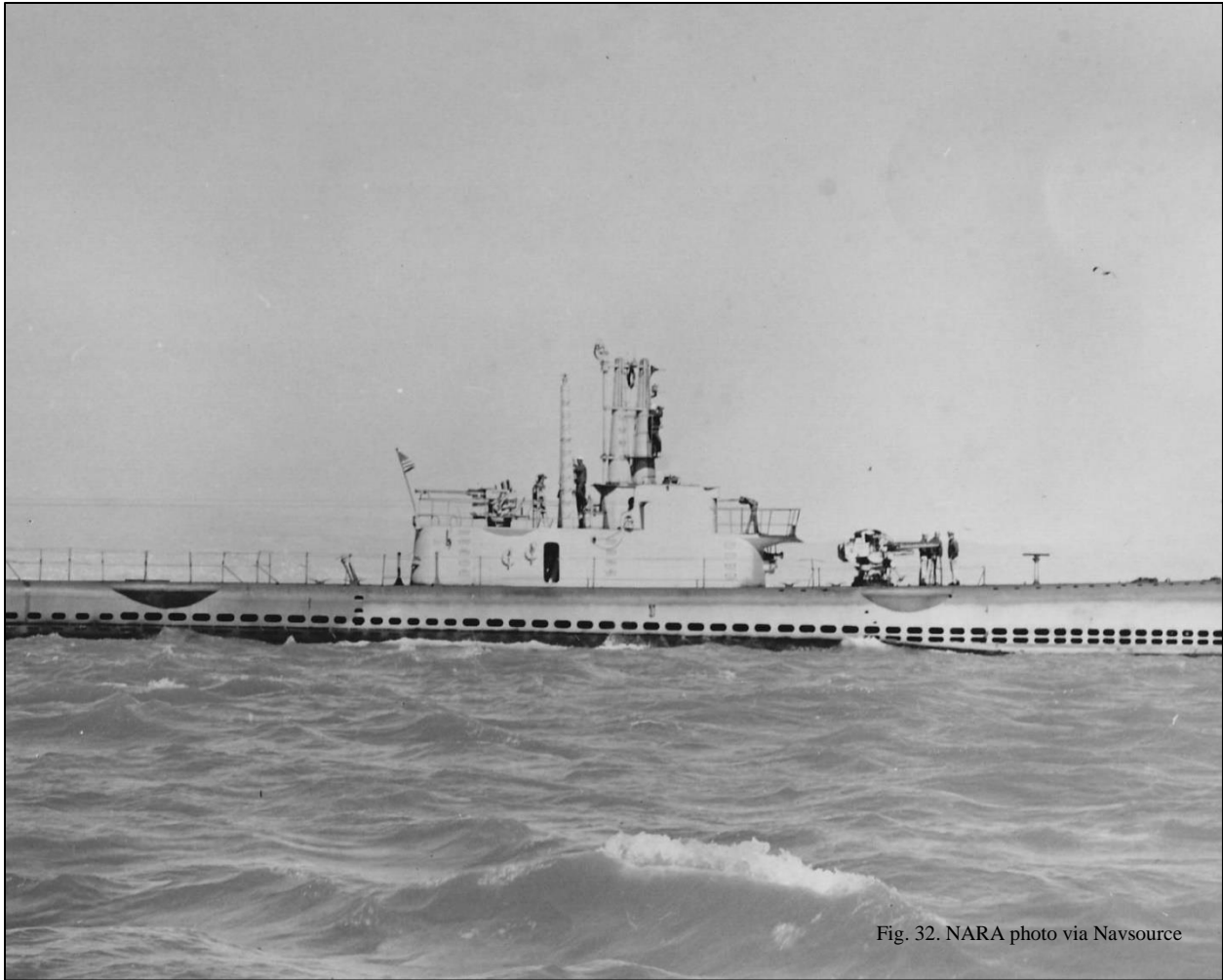


Fig. 32. NARA photo via Navsource

Despite the visual similarity of these two boats to the *Balaos*, two major differences set them apart. Firstly, both boats were refitted with a massive and distinctive wind venturi on the front edge of the bridge. Secondly, the elimination of the watertight door in the aft end of the conning tower in the *Balao* design allowed the repositioning of the main induction valve closer to the conning tower. Combined with a smaller design for the man-sized mushroom-shaped valve, this had the desirable effect narrowing the fairwater to a fine point at the aft end in the early *Balaos*, or of shortening the fairwater altogether in the later boats. The size of the cigarette deck gun platform had to stay the same, so the platform overhung the aft end of the fairwater, giving the *Balao* and *Tench* boats a look very distinctive from the other classes (see Part 5 of this series).

The *Flying Fish* and *Steelhead* did not have their main induction valves moved forward and thus they retained the original, long *Gato* class fairwater design. They did not have the overhang at the aft end of the fairwater; this area remained rounded on the end with the cigarette deck much longer when compared to the *Balao* class.

OTHER VISUAL FEATURES

As built, the EB design had a single row of semi-circular limber holes along the bottom edge of the superstructure just aft of the bow planes. This allowed the superstructure to flood faster when diving. The Government design had two rows of smaller oval shaped holes in the same area. As the war progressed, dozens of additional holes were drilled or cut in an attempt to speed dive times.

There was no official pattern to these additional holes and they were often times done between patrols by tender crews at the behest of the boat's commanding officer.

The first three boats built at EB, Portsmouth, and Mare Island all had two anchors when completed. One of these anchors (usually the port side, although this varied a little) was removed as part of the "frivolous equipment" purge of early 1942 and the hawse hole plated over. All subsequent boats from all yards were built with only one anchor and hawsehole. The EB design standardized on a starboard side anchor and the Government design on a port side one.

Several boats had their bow planes modified to decrease diving times by having them stow against the superstructure in a full dive position. Thus, when rigged out they took an immediate bite in the water and pushed the bow downward much quicker. This feature is very apparent in Figure 30.

For security reasons, immediately upon commencement of hostilities the boat's hull number was painted out. Only submarines assigned to training duties stateside (i.e. *Cachalot*, *Cuttlefish*, *Porpoise*, some O, R, & S-class boats, etc.) carried their hull numbers during the war period. For boats making war patrol workup/training cruises in Hawaiian waters, a temporary two-digit number can sometimes be seen in a few pictures. These numbers aided local anti-submarine patrol units in identifying our submarines and helped reduce friendly fire incidents. The numbers were non-specific to actual hull numbers and were sometimes reused.

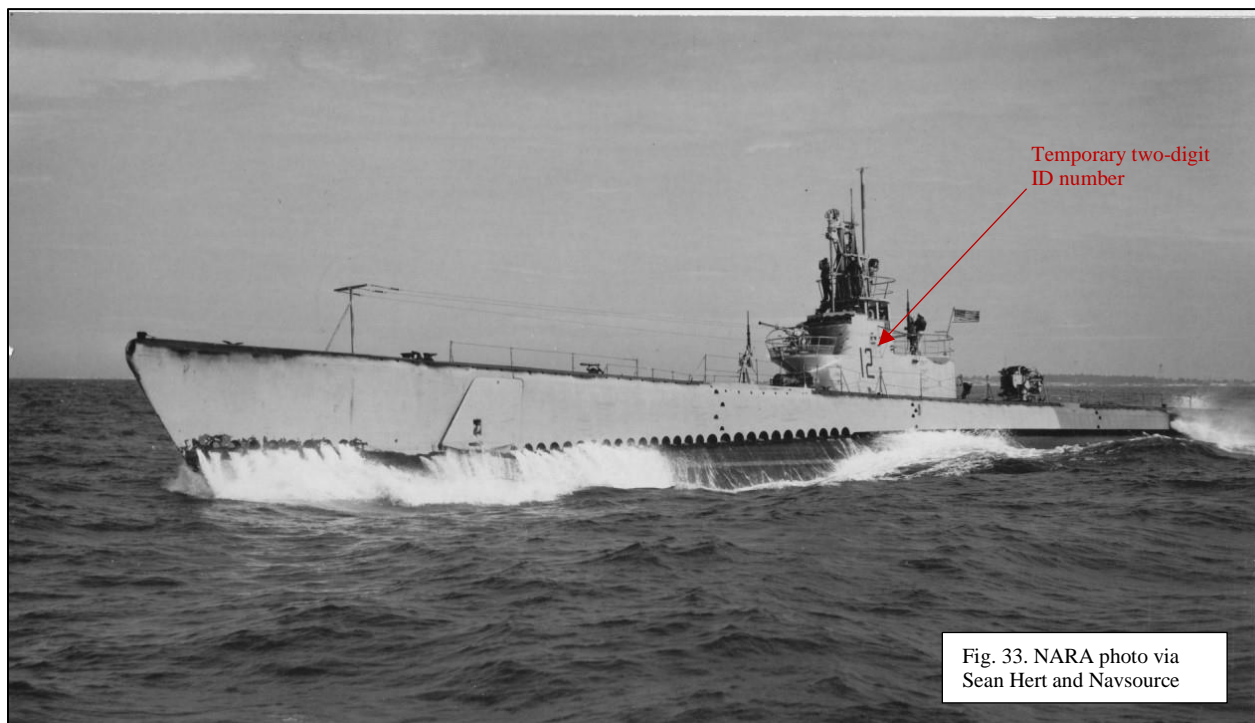


Figure 33 is an early 1945 photo of a Mod 4 *Peto* near Midway. It illustrates these temporary numbers. *Peto* has a typical late war equipment loadout, SJ-1 radar, SD radar, 40 mm gun forward, 20 mm gun aft, a single 20 mm gun sited forward of the fairwater, and a 5"/25 caliber deck gun sited aft.

All fleet submarines up to the early *Gatos* were equipped with mine cable cutters installed as original equipment. These retractable saw-tooth cutters were installed on either side of the bow, on the upper edge of the superstructure forward of the bow planes and above the torpedo tube outer doors. For normal cruising the cutters were rigged in and stowed inside the superstructure and covered by clamshell-style doors that were hinged to open upwards.

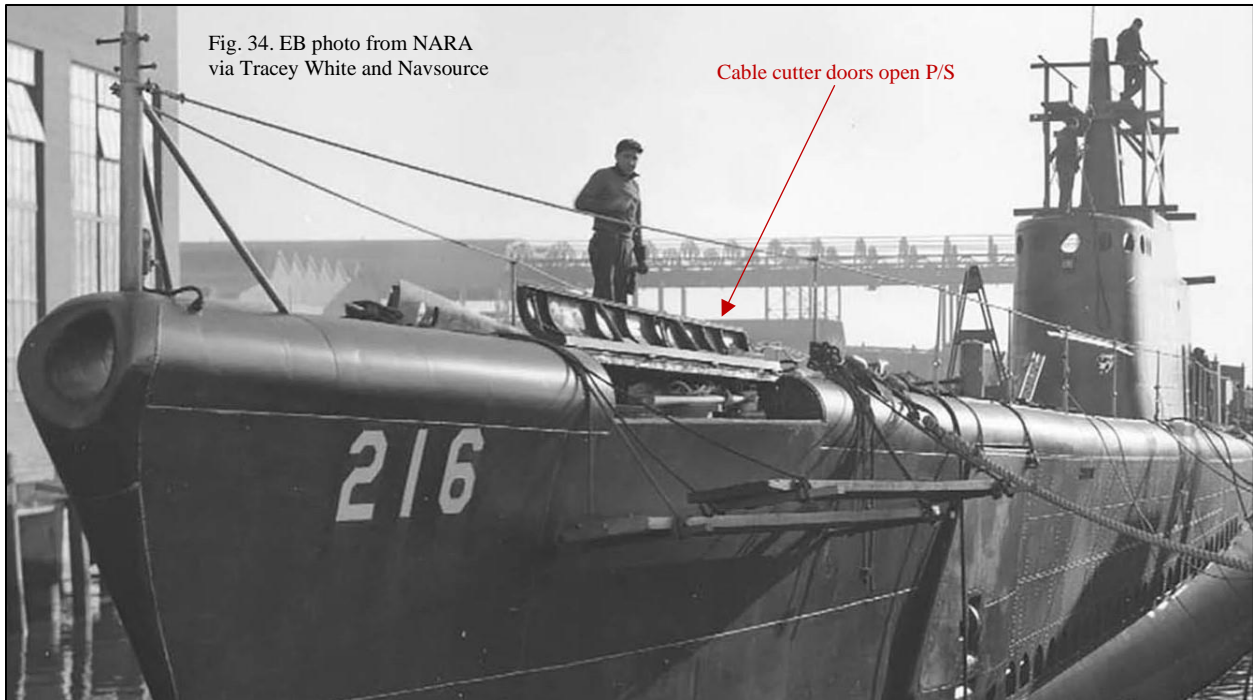


Figure 34 shows *Grunion* under construction at Electric Boat on 30 December 1941. It clearly shows the mine cable cutter doors swung open with the cutters themselves in the stowed position. There is a temporary scaffolding platform erected just below the doors. The workman standing on the deck gives a good reference to the door's scale.

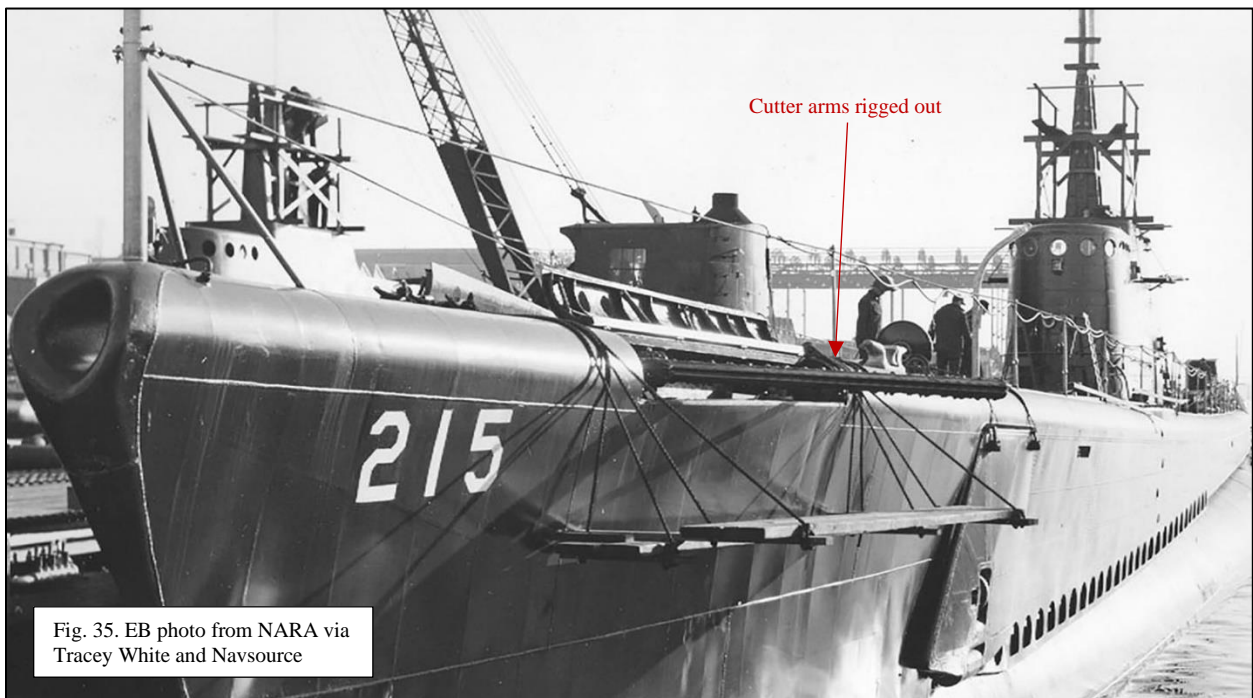


Figure 35 is a photo of sister boat *Growler* taken on the same day at the next pier over. It shows a similar scene, but with the cutter arms in the deployed position. The serrated teeth on the arms were designed to catch and cut mine cables as they slipped along either side of the bow. It should be noted that photographs with these doors open and the arms rigged out are extremely rare. With one exception (an obscured photo of *Squalus*), this photograph is the only one that this author has ever seen. Indeed, most reference texts don't even mention them, most likely due to the fact that when the doors are shut there is almost nothing to give away their presence. The efficacy of these

cutters is not known, but the attitude of the boat's crews towards them can be inferred from the fact that they were authorized for removal by the Navy's General Board after review by the Submarine Officers Conference on 19 June 1942. This was part of the ongoing "frivolous" equipment purge of early 1942 designed to put the boats in fighting trim by eliminating unneeded or unwanted equipment designed into the boats during the pre-war years. It is likely that at least 20 *Gatos* were built with these cutters, the remainder having them eliminated during construction or never installed. The 20 that had them installed had them all removed by the summer of 1942.

CONCLUSION

As you can see, the *Gato* class submarines went through numerous configuration changes during their wartime careers, although these changes aren't as random as they might first seem. They were driven by solid tactical experience gained the hard way, and in some cases can be credited with the safe return of a boat from patrol. Some sense can be made of these changes and once understood, can greatly aid in the accurate identification of photographs.

POSTSCRIPT: TAMBOR/GAR CLASS

The twelve submarines of the *Tambor/Gar* class were the immediate precursors to the *Gato* class. They represented the high-water mark in the development of the USN fleet submarine prior to the war. All the hard-earned lessons learned during the rapid development of the fleet submarine concept during the 1920's and 30's were poured into these boats. Although authorized in two different fiscal years (FY-39 & 40), the six boats each of the *Tambor* and *Gar* classes were actually identical in design with no significant differences between the two groups. They will be considered as one class in this article. Ultimately proven to be quite successful, they were used as the basis for the follow-on FY-41 boats, the war winning *Gatos*.

Outwardly, these boats were nearly indistinguishable from the *Gatos* and indeed went through many of the same wartime modifications that their later cousins received. A few features though will make these boats stand out.

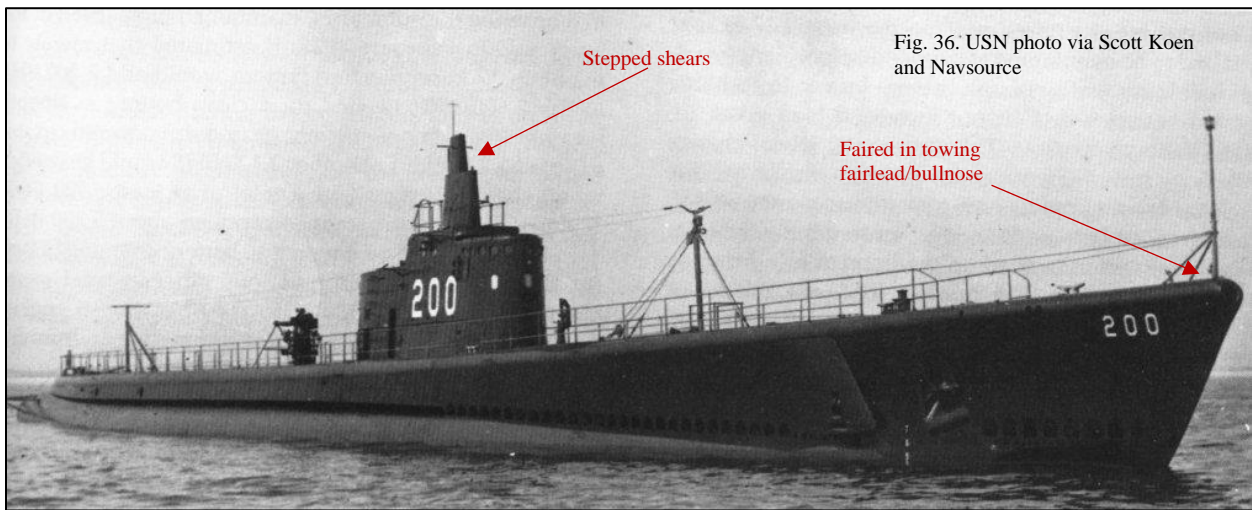
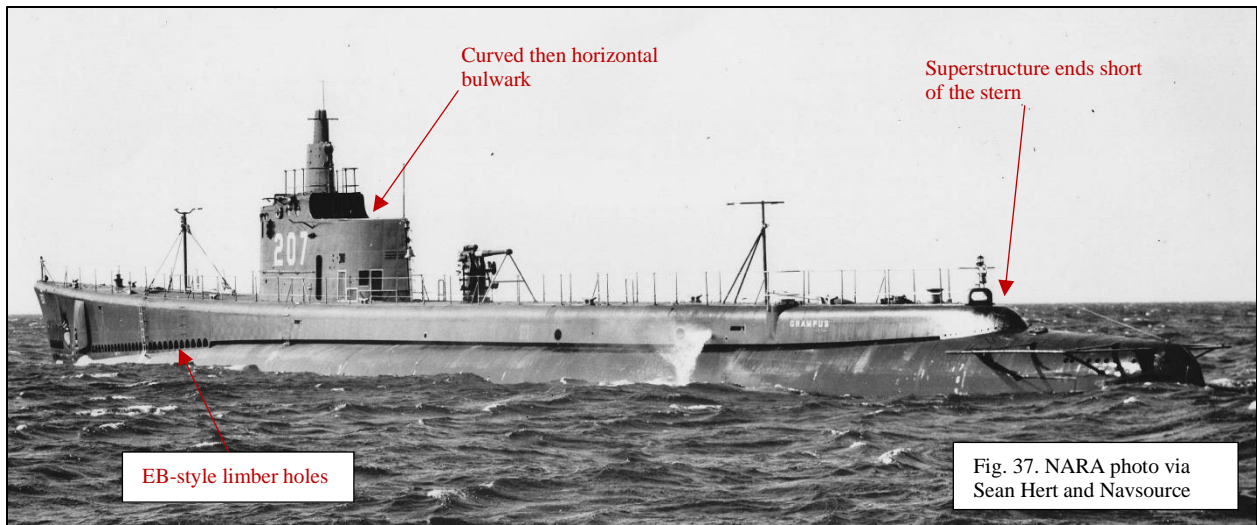
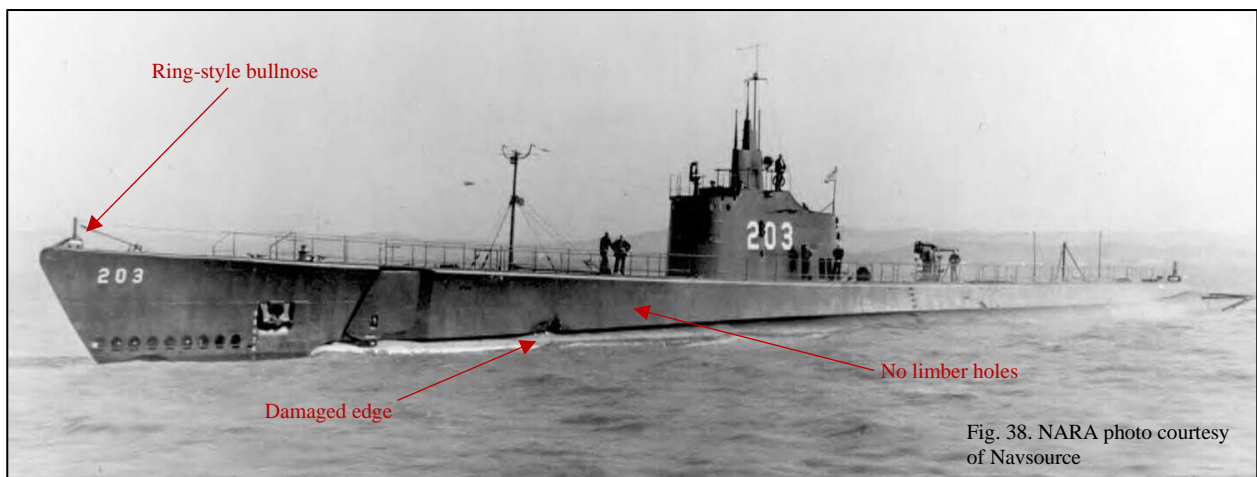


Fig. 36: USN photo via Scott Koen and Navsource



Figures 36 and 37 show *Thresher* and *Grampus* in the classic as-built EB Mod 1 configuration. As you can see, they are nearly indistinguishable from the *Gatos*. The only readily apparent difference is in the periscope shears. All of the *Tambor/Gar* class boats had two 40-foot periscopes, but they were the last class to retain a periscope station in the control room. The lower location of the #1 periscope eyepiece dictated a shorter shear support for that periscope, giving the shears a stepped appearance. Later modifications eliminated the control room station and both scopes eventually let into the conning tower. The only other external difference between these boats and the later *Gatos* is that the *Tambor/Gar* class was five feet shorter. This was due to the fact that all four main engines and generators were contained in one large engine room. Concerns over flooding of this one large space led to the *Gato* class engine room being divided in two, with a watertight bulkhead between them. The *Gatos* were lengthened slightly to accommodate this bulkhead. However, this difference in length is not readily apparent in photos. Notice how EB continued the practice of fairing the bull nose towing fairlead into the superstructure as they did with their *Sargo* class boats. You can see that for the first time the superstructure aft ended short of the hull, much different from the preceding *Porpoise/Shark/Perch* and *Salmon/Sargo* classes which had the aft end faired into the rest of the hull. This feature was continued on all subsequent fleet submarine classes.

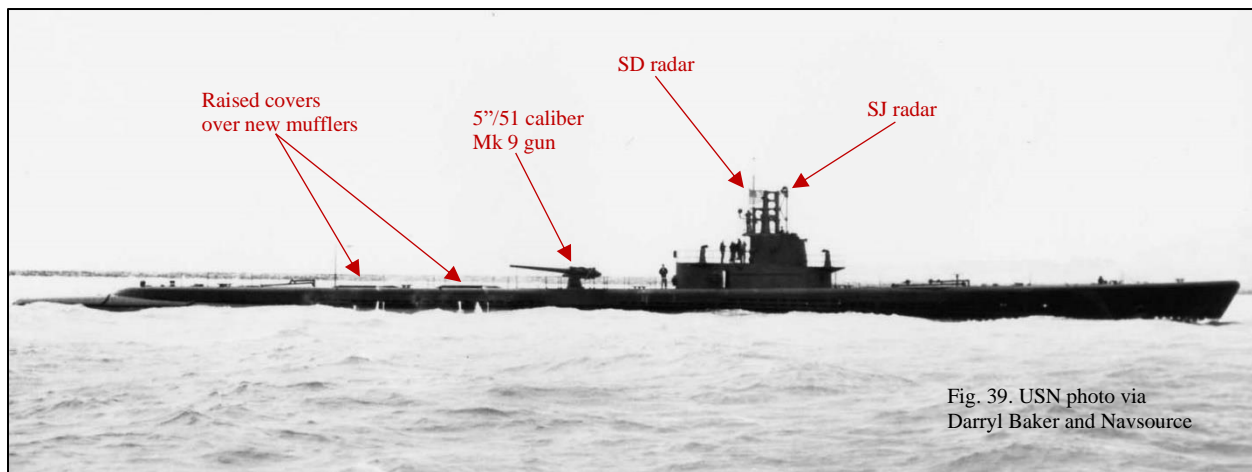


The Mare Island built *Tuna* (Figure 38) is typical of the Mod 1 Government design for these boats. There are few differences from the EB boats, but two features stand out. Continuing the practice from the earlier *Salmon/Sargo* class, the six Government built *Tambor/Gars* were the last to have the above deck, ring-type bull nose towing fairlead at the very tip of the bow. All fleet boats built after this point, whether EB or Government design had the faired-in style bull nose. Also, the EB

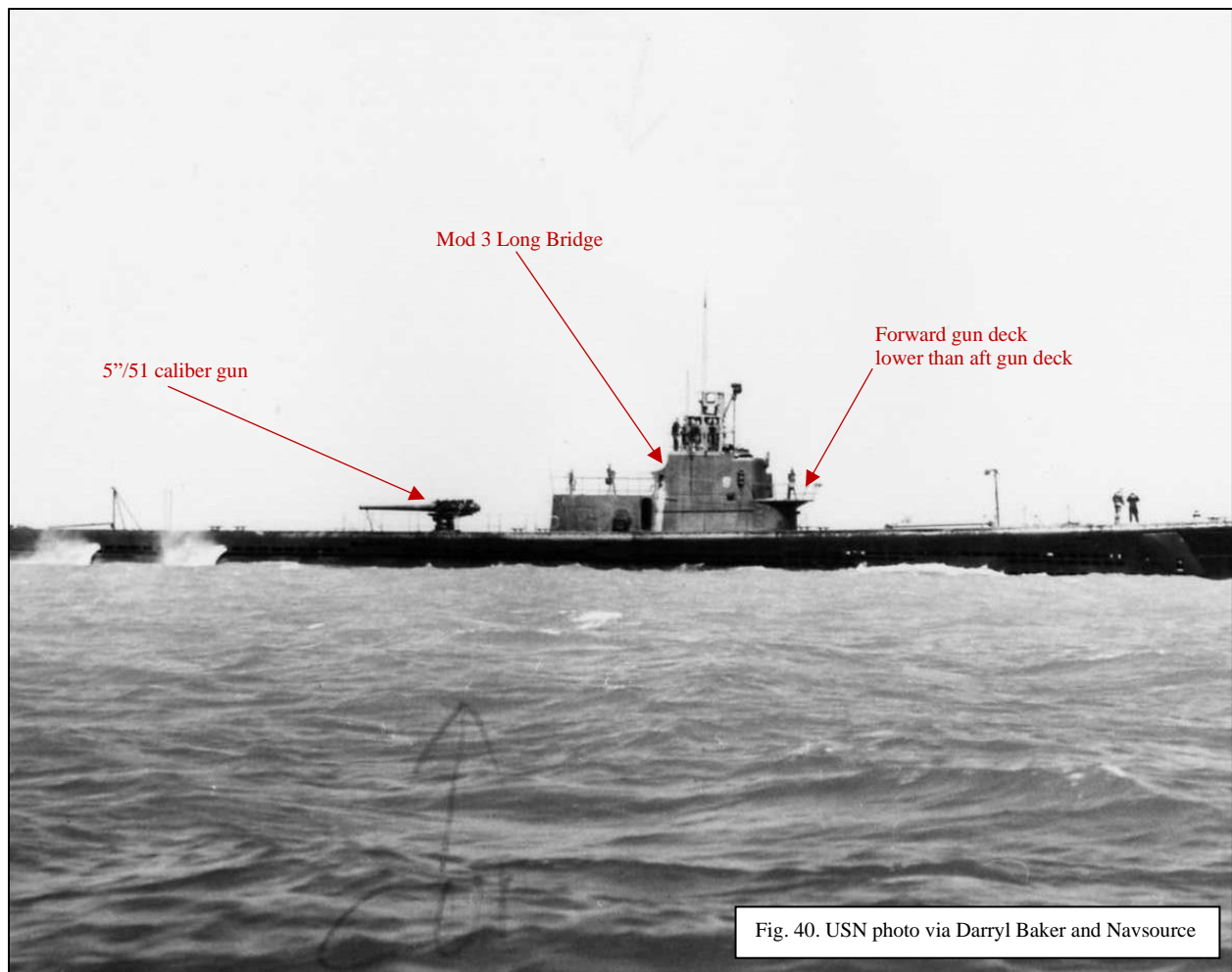
style large semi-circular limber holes aft of the bow planes for flooding the superstructure are absent on the Government boats. There is a slight gap between the bottom edge of the superstructure and the pressure hull on the Government boats and it is here that the water floods in. This tended to slow dive times and shortly after commissioning most of the Government *Tambor/Gars* were retrofitted with a small set of limber holes. This photo of *Tuna* is interesting in that she seems to have some damage to the superstructure along the superstructure bottom edge, just aft of the forward radio aerial mast.

As I stated above, these boats were so similar in design and capability to the later *Gatos* that they went through many of the same wartime Mods. Curiously, one that seems to be missing is the Mod 2. I have yet to see a photo of a *Tambor/Gar* with a Mod 2 fairwater, although it is likely that this mod was applied to most of the boats at some time. The most likely explanation is an incomplete photographic record due to the heavy losses suffered by this class.

The mod that appears most often for the hard fighting *Tambor/Gars* is the Mod 3. Figure 39 below is of *Thresher* on 8 October 1943 and is typical of this mod.



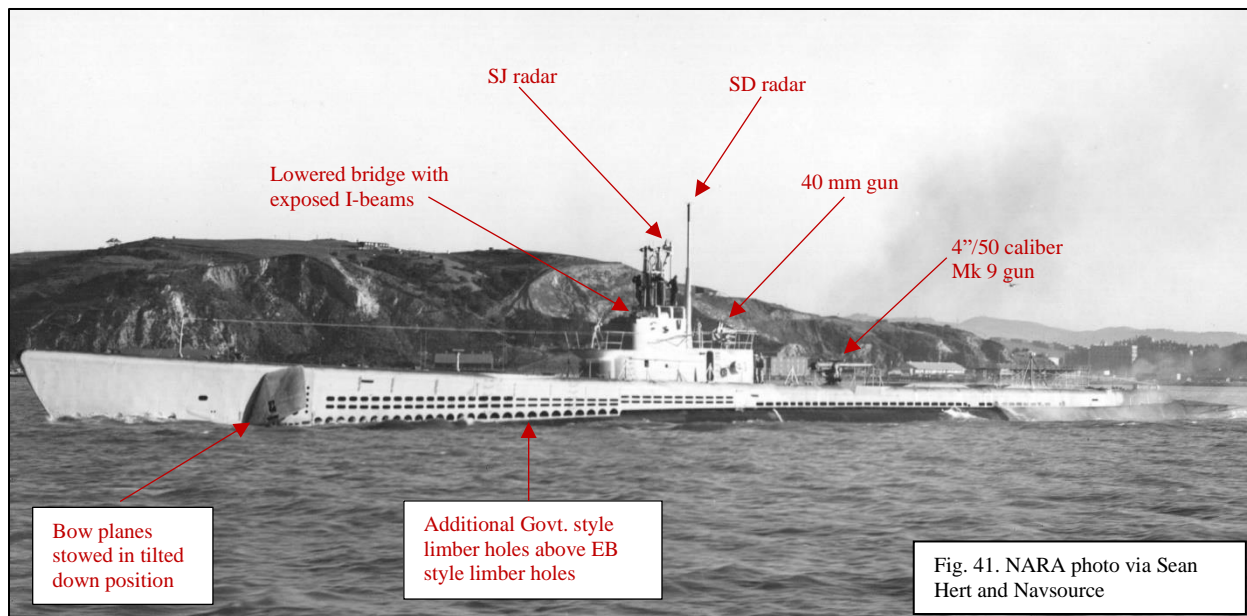
This shows the cut away of the forward pilothouse and the aft cigarette deck bulwark. The SJ radar mast is mounted forward of the shears and the SD mast aft of the shears. The bridge fairwater is cut away under the aft lookout platform and ready-use ammo tubs have been added on the aft edge of the fairwater near the deck. The 20 mm mounts are still the older Mk 5 solid base type; the lighter weight tripod mounts will come later. On the main deck aft of the gun mount you can see raised platforms over the engine mufflers. On older fleet boats that were re-engined, this was sometimes necessary to accommodate the larger mufflers of the new engine types. However, with the *Tambor/Gars* the Navy was quite satisfied with the GM/Winton 16-248 and Fairbanks-Morse 38D8 1/8 diesels that were installed in these boats. In this case the raised platforms covered larger water-injected mufflers that were installed to suppress spark flashes at night. The original 3"/50 caliber deck gun has been replaced with a large 5"/51 caliber Mk. 9 gun at the insistence of Vice Admiral Charles Lockwood. Six of these submarine adapted guns were available, three taken from the old *Barracuda*-class submarines, and three spares. All six went to *Tambor/Gar*-class boats. Not apparent in this photo is the flared-out sponson on the port and starboard sides of the superstructure needed for the gun crew to maneuver this large gun through its full firing arc. Intended to provide more hitting power than the diminutive 3"/50 caliber, this large gun proved to be unwieldy in the war zone on the low deck and its use was not repeated on the *Gatos*.



The ill-fated *Grayback* is shown here with a Mod 3 Long Bridge, a 5"/51 caliber gun, and the later Mk 10 tripod mount 20 mm anti-aircraft guns on the forward and aft gun decks. *Gudgeon* also received a similar mod prior to her loss. This photo illustrates that on many of the *Tambor/Gar* and *Gato* class boats the forward fairwater gun deck was actually lower in height than the aft fairwater deck. The aft gun deck height was the same as it had been for the original Mod 1. The upper bulwark was simply removed leaving the deck where it was at. It could not be lowered due to the height of the main air induction valve directly below it. On the other hand, the forward fairwater gun deck could be any height the crew wanted, with the interior structure of the bridge taken into account.

All of these boats were built with two anchors (port and starboard) and two motor whaleboats stowed in the superstructure near the forward gun foundation. One of the two anchors and both boats were deleted as part of the wartime purge of unnecessary peacetime equipment.

The Navy heavily relied on the *Tambor/Gars* to lead the fight against the Japanese. Thus, seven of the twelve were lost in combat. Of the survivors, *Tambor* received a Mod 4A (the only one to receive this mod), *Tautog* a Mod 3, *Thresher* and *Tuna* a Mod 4, and *Gar* probably finished the war with a Mod 3.



Tambor alone seemed to have received the full suite of mods, with the photo above showing her with a Mod 4A, a 40 mm on the cigarette deck, open mount 20 mm on the forward gun deck, and the SD radar on the separate mast. She also lost her big 5"/51 gun in favor of the smaller but easier to use 4"/50. Note also the additional limber holes cut into the superstructure aft of the bow planes. Curiously, although an EB built boat, the new limber hole pattern was actually the standard pattern applied to the Government built boats of the *Gato*, *Balao*, and *Tench* classes. The original EB style limber holes can still be seen along the bottom edge of the superstructure.

ACKNOWLEDGEMENTS

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