DOCKING REPORT MANUAL

Guide To Fouling Organisms
and
Instructions Regarding
The Docking Report

Bureau of Ships
Navy Department
Washington, D. C.

1942

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PREFACE

The Navy is devoting much time and effort to the improvement of its formulas for ship-bottom paints. Because many different factors control the amount of fouling and corrosion, new formulas should not be adopted for widespread service use until they are tested under service conditions. Since further improvement is guided by information which can be obtained only at the time of docking, it is essential that the docking reports be as complete and accurate as possible. The data they contain will be summarized for statistical analysis.

This booklet was prepared to assist docking officers in filling out the present form (N.B.S. 223), especially in regard to estimating the extent of fouling, and identifying the marine life with which a ship is fouled. It is requested that particular care be taken to insure that the reports are prepared with care and submitted promptly.

INTRODUCTION

HOW SHIPS BECOME FOULED

The fouling of a ship's bottom begins as soon as the ship is waterborne, regardless of the fact that the bottom as a whole may never become visibly fouled. The process of fouling can be divided into three phases, which may take place, however, more or less simultaneously. These are the formation of a slime film, the attachment of macroscopic, or visible, fouling organisms, and the growth of these larger forms.

The slime begins to form immediately on any surface that is submerged in the sea. It is produced by microscopic plants and animals which secrete a slimy substance. Particles of sand, silt, and organic material then become attached to this film which may become fairly thick in a short period of time. Films as much as a millimeter and a half (0.06 inch) in thickness have been observed on test panels.

The slime film may influence the attachment of macroscopic fouling forms, the second phase of the fouling process. It has been repeatedly demonstrated that this film concentrates the metals which are put in the paint as poisons. A very slimy film forms a surface to which the larger fouling forms appear to attach with difficulty. On the other hand, a "silty" film (one which is granular or sandy in consistency) seems to have very little influence on the attachment of fouling.

The attachment of the macroscopic or visible fouling forms starts the critical stage of fouling. The effectiveness of an antifouling paint must be measured by its ability to hinder the attachment of these organisms, since, when once attached, they seem to grow regardless of the toxicity of the paint.

All of the important macroscopic forms begin as tiny, microscopic forms, called larvae. For a short time these larvae swim freely in the water. Then, after a period which varies from a few minutes to several weeks, depending upon the kind of organisms, they must become attached to a surface in order to survive. After their attachment, the larvae change to the adult shape, and grow very rapidly. The poisons in the paint seem to have little or no effect on the adult organisms.

An effective antifouling paint must therefore prevent the *attachment* of the fouling organisms.

FACTORS AFFECTING FOULING

Numerous factors influence the amount of fouling on a ship's bottom. Ships in tropical and sub-tropical waters foul more rapidly than those in northern, colder waters. In southern waters fouling takes place all year round. In northern waters very little fouling occurs during the winter, but in summer the amount may be heavy. The amount of fouling depends to a great extent on the history of the ship since the last docking. Fouling is always heavier in harbors than in the open ocean. Furthermore, some of the younger and

some soft-bodied forms may be removed from the moving ship by the friction of the water. Consequently, a ship which lies at anchor for long periods is much more likely to foul than an active ship. Since most of the forms which attach in tropical waters cannot live in cold water, a ship which cruises north and south frequently has less fouling than one that stays in the same latitude. Fresh water will kill most of the marine fouling forms. The large shells of the adults will remain after the animal is dead, however, so that a trip into fresh water is less effective in reducing skin friction than is popularly supposed.

Perhaps the most important factor influencing the amount of fouling is the paint applied at the last docking, and the length of time this paint has been exposed to the action of sea water. Paints differ considerably in their effectiveness. Some are very efficient for short periods of time but are rendered ineffective after a few months in the water. No antifouling paint has yet been invented which will be effective indefinitely, but great progress has been made in the last few years, and there is promise of definite improvement over present performances.

GUIDE TO FOULING ORGANISMS

The visible fouling organisms belong to seven main groups. In spite of the fact that the different kinds in each group may vary widely in appearance, they all have certain features in common, and as these features are easy to recognize, any given organism can be placed in the proper group.

Three of the groups are characterized by having hard, often limy shells. These are the Annelids (worm tubes), Barnacles, and Mollusks. Three other groups (the Algae, Hydroids, and Tunicates) include only soft-bodied forms. The members of the remaining group, the Bryozoa, are mostly soft-bodied, but a few have limy shells which form encrusting patches. Thus to identify any sort of fouling organism, the first step is to learn if it has a shell. Next the table on page 10 should be consulted, and finally the identification obtained from this table should be checked with the description of the group to which the organism seems to belong.

When there is difficulty in classifying a soft-bodied form, placing it in a dish of water will sometimes help to show its characteristic structures.

The terms *grass* and *moss* are popularly used for Bryozoa and Hydroids as well as Algae, but they do not have definite meanings when applied to marine organisms. True grasses and mosses do not occur in the sea.

Wooden vessels may support an additional sort of marine organisms—animals that actually burrow into the hull. Shipworms (or teredos), which are the principal type of this class, are true Mollusks. At the far end of their shell-lined tunnels, the typical forms have a clamlike shell which is far too small to contain the long wormlike body, and is used as a cutting instrument to lengthen the curved and twisted burrow. As the entrance to each tunnel at the surface of the hull is relatively small, the extensive damage caused by shipworms is often overlooked.

A second type of animals that burrow in wooden hulls is represented by the Gribble *(Limnoria lignorum)*. This is a small crustacean, 1/8 to 1/4 of an inch long, that looks like a tiny sowbug or woodlouse. It gnaws interlacing burrows in the surface of the wood. As it is often very abundant, the outer layers of an unprotected hull may be speedily destroyed.

KEY TO THE ORGANISMS IMPORTANT

IN THE FOULING OF SHIPS' BOTTOMS

I. Organisms with hard, often limy shells:

A. Coiled or twisted tubular shells. . . . Annelids

B. Cone-shaped shells attached directly to the hull, or shells with a long muscular stalk. . . . . Barnacles

C. Flat, spreading, granular discs or patches. . . . . Bryozoa

D. Paired shells, such as clams, mussels, oysters, etc. . . . . Mollusks

II. Organisms without shells:

A. Green, brown, or red filaments or leaflike structures, generally near water line. . . . . Algae

B. Branching tree-shaped growths, the branches not expanded at the tips. . . . . .Bryozoa

C. Straight or branching growths, each thread terminating in an expanded tip. . . . . Hydroids

D. Rounded soft spongy masses. . . . . Tunicates

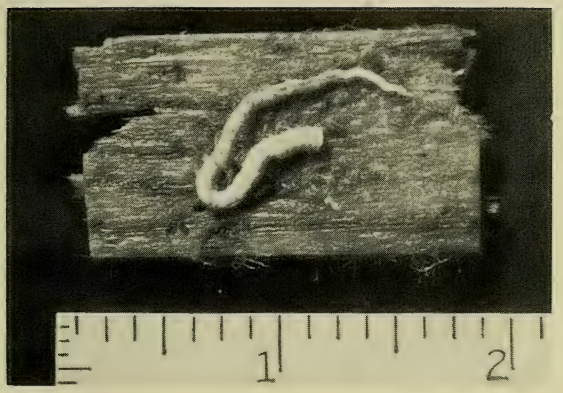

Fig. 1. Annelid.

ANNELIDS (Worm Tubes)

These organisms can be readily recognized by their hard tubular shells (figs. 1 and 13), each of which houses a living worm. Sometimes the whole shell adheres firmly to the hull, but it may rise from the surface and stand out at a sharp angle. These tubes range in length from a fraction of an inch to several inches, and may form a large proportion of the fouling, especially on ships which have been stationed in the Hawaiian Islands or the southern Pacific. Some of the commonest forms have the scientific name of *Hydroides*. This should not be confused with Hydroids, the common name of an entirely different group of animals.

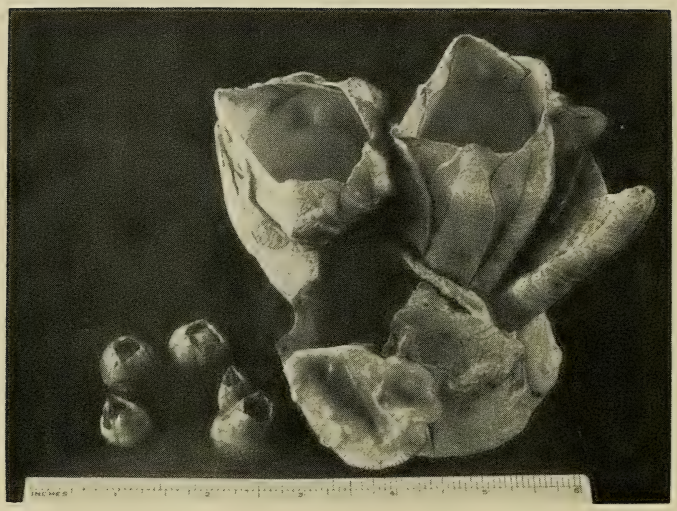

Fig. 2. Acorn Barnacles.

BARNACLES

In many waters, Barnacles are the predominant form of fouling. Two general types are found. Acorn Barnacles (figs. 2 and 18) have a hard, conical shell which is made up of several distinct plates, and varies from a fraction of an inch to several inches in diameter at the base. The top of this cone is covered by four movable plates which may become detached when the animal dies. When the whole cone drops off or is re-

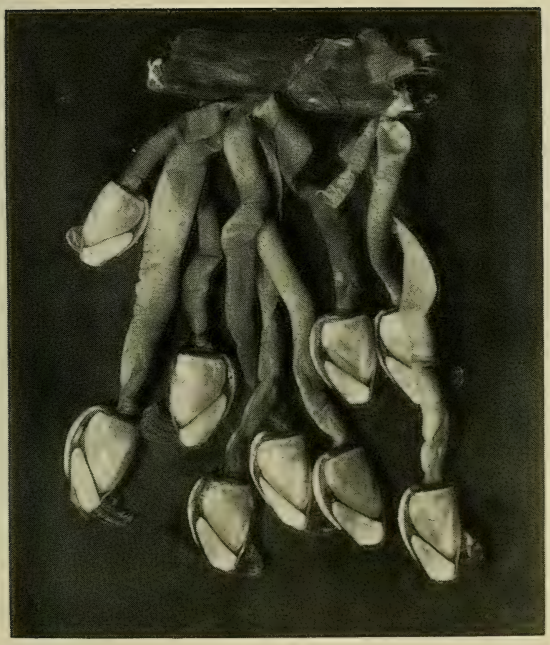

Fig. 3. Stalked Barnacles.

moved from the hull, a basal, limy plate is generally left behind.

The other type of Barnacle is the Stalked or Gooseneck Barnacle (fig. 3). Whereas Acorn Barnacles are attached to the hull by the calcareous plates which form the cone-shaped shell, Stalked Barnacles have a muscular stalk which suspends the body from the hull. The body proper of both types is always protected by limy plates.

Fig. 4. Mussels (Mollusks).

MOLLUSKS (Shellfish or Bivalves)

This group includes the familiar edible clams, oysters, and mussels (fig. 4). All of the forms important in fouling are characterized by having paired or "two-valved" shells. They are generally attached to the hull at the region of the hinge of this double shell. Very many shapes are found, but all are characterized by this paired hinged shell, a structure not found in any other group of fouling organisms. Mollusks may grow to a large size, and since they may become attached to other Mollusks which in turn are attached to the hull, they frequently build up a large bulky mass of fouling.

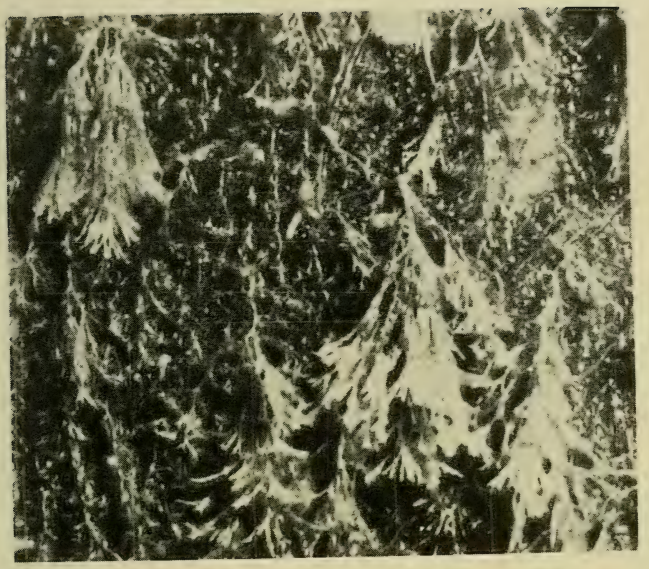

Fig. 5. Bryozoa (soft-bodied forms).

BRYOZOA (Coral Patches, etc.)

The Bryozoa include some soft-bodied, and some hard-bodied forms. Bryozoa are colonial animals, the colony being made up of hundreds or thousands of minute individuals. The colony may vary in appearance from a branching structure suspended by a single strand (fig. 5) to a moss-like mat of material or a thin encrusting growth (so-called coral patch) which spreads over a large area

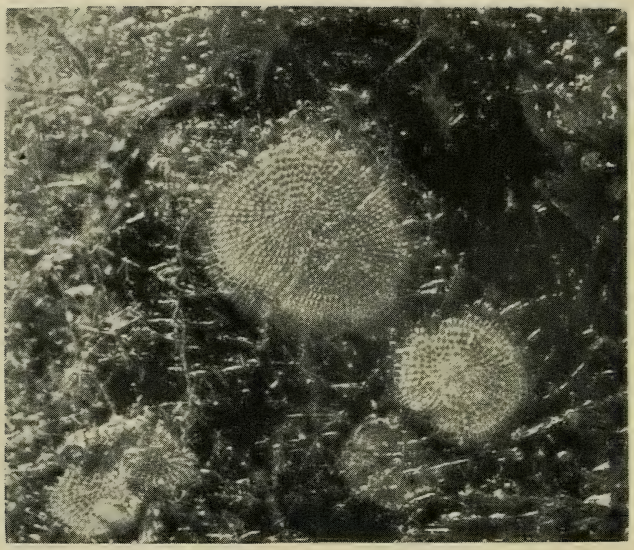

Fig. 6. Bryozoa (coral patches).

(fig. 6). When an adult Barnacle falls off the hull it generally leaves behind a circular patch or base plate. This may resemble a coral patch. The base plate of the Barnacle is marked by lines, whereas the coral patch is distinctly granular in appearance. The flat encrusting type of Bryozoa is frequently hard and calcareous, whereas the branching type is generally soft and flexible.

Fig. 7. Algae.
A, D, E, green algae; B, a red alga; C, a brown alga.

ALGAE (Green "Moss", Brown "Moss")

The zone of fouling just below the water line is usually composed of Algae. These are true marine plants, and aside from microscopic forms and a few flowering plants, the only members of the vegetable kingdom that occur in the sea. Since they cannot grow without light, they are seldom found on the deeper portions of the hull between the bilge keels. The commonest types are green in color, but others are various shades of red, brown, and purple. (In the docking reports,

"brown moss" should include all the forms which are not definitely green.)

The characteristic fouling forms consist of mats of long slender threads or filaments, usually branched (fig. 7, A, B, and E). Others have fronds resembling ribbons or leaves of lettuce (fig. 7, D), and still others (known as rockweeds) have hollow swellings which serve as floats (fig. 7, C).

It is desirable to distinguish between green and brown algae. The latter are considered more objectionable in that they adhere more tightly. Consequently they often tear off the paint in the wind and water area which is then subject to increased fouling and corrosion.

HYDROIDS

Hydroids (figs. 8 and 9) are small animals with slender stalks. Joined together like Siamese twins, they usually live in plantlike colonies composed of many individuals. Each branch of a colony represents a single individual. At the end of each branch is a flowerlike expansion, frequently pink in color. These expansions readily distinguish Hydroids from the branching types of Bryozoa. When attached to a hull, Hydroids often form a pale cream or tan mat which may be very thick and extensive.

For a discussion of the term *Hydroides*, see page 11.

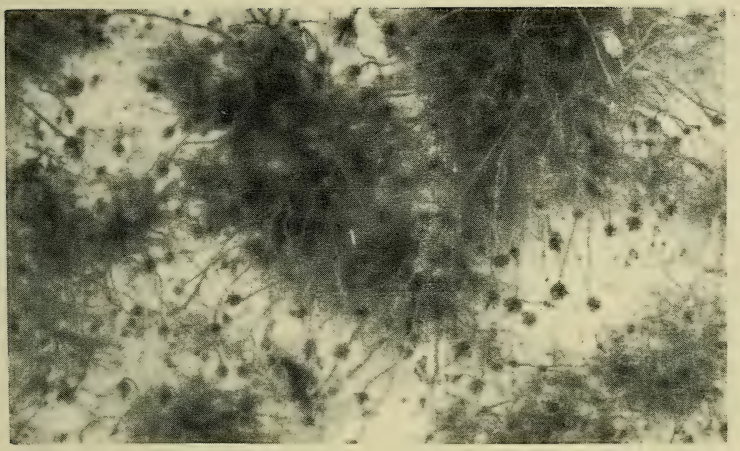

Fig. 8. Hydroids, attached to a panel, normal size.

Fig. 9. Hydroids, enlarged.

Fig. 10. Tunicates photographed under water.

TUNICATES (Sea Squirts)

Tunicates are soft-bodied, more or less leathery animals of various irregular shapes, often with a translucent covering (figs. 10 and 11). Each individual has two openings, one used as the intake and the other as the discharge for the sea water from which they sift their food, but as some kinds are colonial, a single mass may have more than one pair of holes. From their habit of expelling sea water, sometimes from both openings at once, these animals have also received the name of sea squirts.

Fig. 11. Tunicates on an exposed hull.

INSTRUCTIONS REGARDING THE DOCKING REPORT

As shown in the introduction, the extent of fouling is dependent on the areas in which a ship has operated, the time of year when it visited these areas, the total period out of dock, and the percentage of days when the ship was moored. Without this information, there is no way to estimate the severity of the conditions to which a ship has been exposed, which is the basis upon which to measure the effectiveness of the paints.

Some of these data for the docking report must be obtained from the commanding officer of the ship. The first page of the form (N.B.S.223a), which has been printed to simplify the gathering of this information, is reproduced on the opposite page. The material on the reverse of this form is quoted below.

Other data required in the docking report will be found in the report of the previous docking. In case the ship was last docked at another yard, the above form will indicate whether a report of this docking is available in the ship's files.

MOORING AREAS

"Absolute precision in this part of the report is unnecessary as the Bureau of Ships simply wishes to learn whether the paint on the ship's bottom has been exposed to virulent conditions of fouling.

"The accompanying map indicates ten oceanic areas, each of which is reported to have distinc-

N.B.S.223a

SUPPLEMENTARY DATA FOR DOCKING REPORT

TO BE SUPPLIED BY VESSEL TO BE DOCKED

This report may be filled out in longhand. One copy only is required. If the information demands a security classification, indicate the category in an appropriate space (ref. Navy Regulations 75½).

From: Commanding Officer, U.S.S. _____
Ship to be docked

To: _____
Agency preparing the docking report

1. Is report of last docking available in ship's files? _____
   It may be necessary for the docking officer to consult this report if the ship was last docked at another yard.

2. Date of last docking. _____

3. Percentage of inactivity since last docking.

   $$\frac{\text{Days not underway}}{\text{Days waterborne}} = \_\_\_\_\_ = \quad \%$$

4. Environment since last undocking. See over.

   MOORING AREAS *(in order of relative duration)*

	LOCALITY	MONTHS BY NAME
Longest		
2nd longest		
3rd longest		
4th longest		
5th longest		

5. Propellers were last cleaned on _____

6. Boottop area was last touched up by ship's force on

   _____ using formula _____

7. What are titles of unit and force commanders to whom a copy of the report of docking should be sent?

   _____

   _____

   _____

A28107

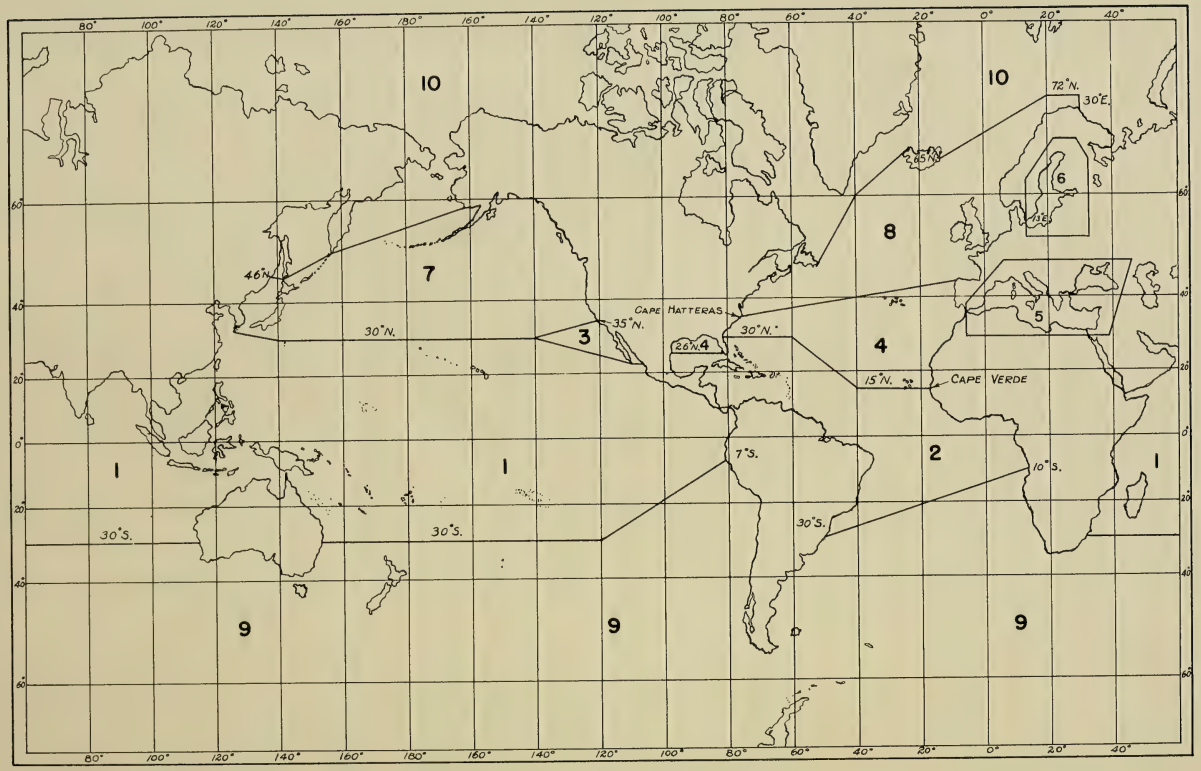

Fig. 12. Areas of different fouling conditions.

tive features in regard to fouling. These regions are numbered in approximately the order of their relative severity.

"Before filling out the table on the reverse side, jot down in chronological order the areas in which the vessel has moored since last undocking. Then group together all successive moorings which were in the same area.

> "For example, if a ship which has been operating out of Boston in area 8 makes test runs off Rockland and then returns to Boston, all the time moored in either port is included in the time spent in mooring area 8.
>
> "But if the ship makes a shakedown cruise to Guantanamo, the fouling organisms which may have attached in area 8 are exposed to different conditions, especially of water temperature. This may cause them to die while other organisms may attach. Upon the return to mooring area 8, the tropical fouling is exposed to temperate zone conditions, and may in turn die. Hence mooring during the succeeding operating period in area 8 should form a new line in the table.

"The five longest mooring areas should then be rearranged in order of their relative duration for insertion in the table. Be sure to include the names of the months in which these moorings took place."

FOULING GRADES

To aid in judging the extent of fouling, photographs showing all but "negligible" fouling are reproduced as figures 13-16. The grades established by these photographs may seem rather severe, but it should be emphasized that *any* fouling in a given area represents a partial failure of the paint. The percentage of film area that is ineffective is more important than the total weight or thickness of the fouling.

When the fouling is evenly distributed over a hull (not concentrated in definite patches), the grading should take into consideration the fact that such areas may soon become fouled completely, either by the enlargement of the present imperfections of the film, or by the attachment of additional fouling upon that already in place. Uniformly distributed fouling indicates that the fault probably lies in the formula of the paint, whereas "patchy" fouling indicates improper mixing during manufacture or application. (The gradings in the table on page 2 of the docking report contemplate the greater likelihood of "patchy" fouling.) The following scale will help to correlate these gradings for both situations.

PERCENTAGE OF GIVEN AREA UNIFORMLY FOULED	CORRESPONDING GRADE OF "PATCHY" FOULING
0-5%	"negligible"
5-10%	"in isolated small spots"
10-20% (fig. 17)	"in large patches"
20-50% (fig. 18)	"covering larger part of area"
50-100%	"covering area completely"

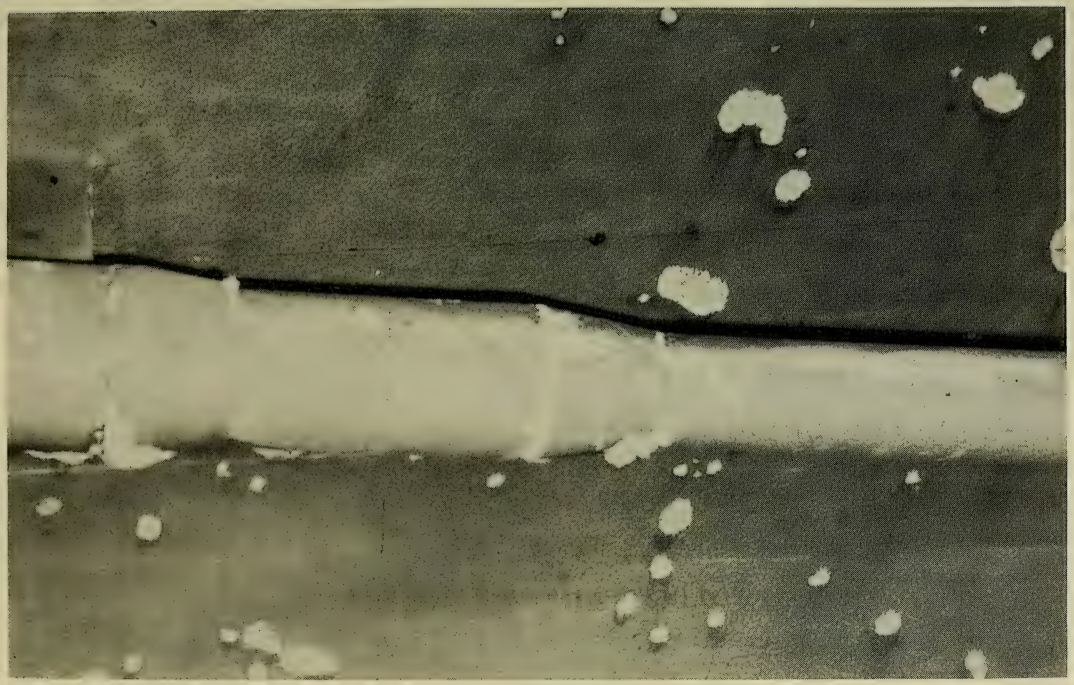

Fig. 13. Fouling in isolated small spots (note clusters of Annelids, common on ships stationed in tropical Pacific).

Fig. 14. Fouling (mostly Hydroids) in large patches.

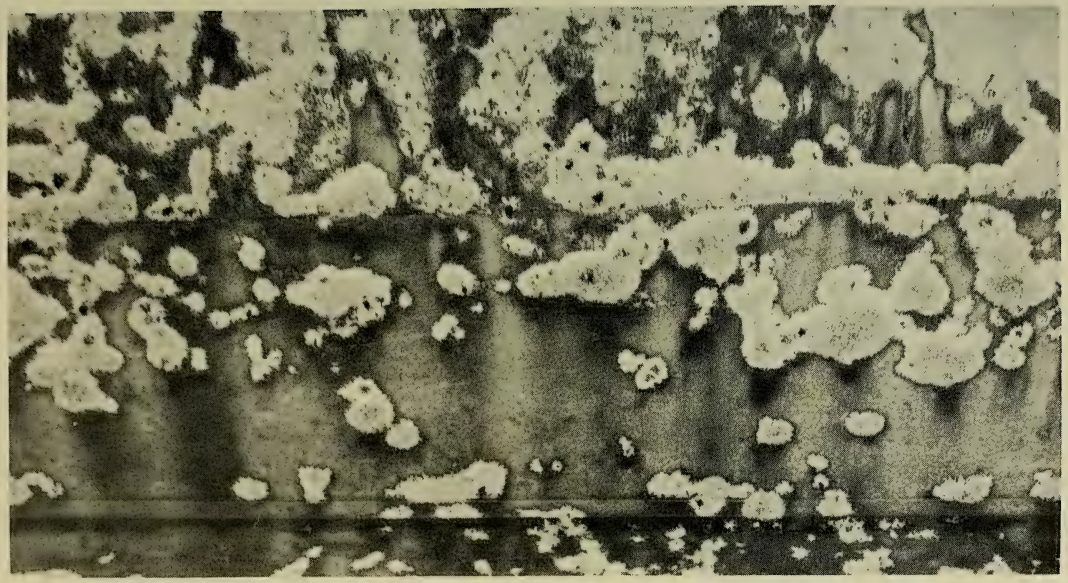

Fig. 15. Fouling (Annelids) covering larger part of area.

Fig. 16. Fouling covering area completely.

Fig. 17. Fouling organisms (Annelids and Barnacles) uniformly distributed. Corresponding to fouling distributed in large patches.

Fig. 18. Fouling organisms (Barnacles with Bryozoa and Annelids) uniformly distributed. Corresponding to fouling covering larger part of area.

SAMPLE DOCKING REPORT

The sample docking report on the following pages is reproduced to show the correct method of filling out the current form. The information included is not intended to form a consistent whole, but has been selected to explain the procedure in special cases.

The notes on the left-hand pages correspond to the circled numbers in the report.

(1) If the report contains information demanding a security classification, it should be so indicated in this space. Ref. Navy Regulations 75½.

(2) Or ship, or office, where report was prepared.

(3) Title of reporting official.

(4) Official number as given in Ships' Data Book. Do not use accounting numbers. Special cases: USCG; WR401; etc.

(5) If ship is unnamed, leave blank.

(6) If preparation of report has been delayed, check this date.

(7) If not supplied by ship on form N.B.S.223a, consult copy of last undocking report.

(8) Calculate from dates of present docking and last undocking. See Table 1.

(9) From docking plans.

(10) Leave blank for use of Bureau of Ships.

(11) To be supplied by ship on form N.B.S.223a. No decimals.

(12) To be supplied by ship on form N.B.S.223a. See instructions on pages 22 and 25.

DOCKING REPORT

(1)

(2) YARD OR STATION Bethlehem Steel Co. (Shipbuilding Div.) Quincy, Mass.

DATE January 30, 1942

(3) From: Supervisor of Shipbuilding, Quincy

To: CHIEF OF BUREAU OF SHIPS

Ship's Class & No. ZZ984 (4)

Ship's Name USS ZEBRA (5)

Yard or Station United Ship Yard Providence, R.I.

Drydock No. Marine Railway #2

Docking Hour & Date 0915 1/25/42 (6)

Last Undocked 11/22/41 (Launched) (7)

Waterborne 64 (8) days.

Docking Position #3 (9)

Undocked Hour & Date 1212 1/28/42

Afterside After Keel Block To Extreme After End 9 ft. 6 ins.

Time in Dock 75 hrs.

DRAFT READINGS

To displacement marks *(Roman numerals where fitted)*

Reason for Docking Installation of new propellers

Docking 8' 4 1/2" Forward 9' 2" Aft

Date Tabulating Card Prepared (10)

Undocking 8' 5" Forward 9' 3 1/2" Aft

BOTTOM INSPECTION

ENVIRONMENT

$\frac{\text{Days not underway}}{\text{Days waterborne}} = \frac{79}{183} = 43\%$ (11)

Mooring Areas *(in order of relative duration)* (12)

	LOCALITY	MONTHS BY NAME
Longest	8	Aug., Sept., Oct.
2nd longest	3	Nov., Dec.
3rd longest	8	June, July
4th longest	2	July
5th longest	4	Oct.

FOULING SPECIES NOTED

	MANY	FEW
ALGAE *(Green Moss)*	X	
ALGAE *(Brown Moss)*		X
ANNELIDS *(Worm Tubes)*		
BARNACLES	X	
BRYOZOA *(Coral Patches)*		X
HYDROIDS *(Colorless, plant-like)*		
MOLLUSKS *(Shellfish, etc.)*		X
TUNICATES *(Sea Squirts)*		
OTHER TYPES		

Number pages consecutively. Add extra sheets as necessary

(13) Enter only antifouling formula number in this space. Do not omit. If no antifouling paint was applied at the last docking, give the formula number last used (if known) and note that it was applied at an earlier docking.

(14) See detailed instructions on page 26. Note particularly that only in column "P" (propeller) blades) is the insertion of an "X" permissible. Elsewhere in the table the numerals 1, 2, or 3 must be used. The figure 3 may be employed when the fouling is too heavy to determine the presence or absence of the antifouling film.

(15) To be supplied by ship on form N.B.S.223a.

(16) Submit photographs of special or unusual conditions if possible. See figs. 19-20.

U.S.S. ZEBRA DOCKING DATE 1/25/42

(13)

FOULING RESISTANCE

Formula 15RC Applied at Preceding Docking

(14)	A AFT OF MIDSHIPS BOOTTOP TO BILGE		B BOTTOM BETWEEN BILGES	F FWD. OF MIDSHIPS BOOTTOP TO BILGE		P PROPELLER BLADES
	PORT	STBD.		PORT	STBD.	
FOULING IS NEGLIGIBLE						X
FOULING IS IN ISOLATED SMALL SPOTS	2			2		
FOULING IS IN LARGE PATCHES		2			2	
FOULING COVERS LARGER PART OF AREA			3			
FOULING COVERS AREA COMPLETELY						

Explain nature of fouling in box above by using appropriate comment numbers. "x" *in column "P"*

1. Fouling is noted only where antifouling film is gone.
2. Fouling is noted on antifouling film which is ineffective.
3. Fouling is so heavy that performance of paint is unsatisfactory.

(15) Propellers last cleaned on 12/31/41

CONDITION OF ANTIFOULING PAINT FILM

15% of total area of AF paint is missing due to:

("x" as appropriate to left of item.)

X a. Failure to adhere to undercoat.

X b. Failure of undercoats to adhere to hull.

c. Film too soft and washes off.

X d. Film too brittle and flakes off.

Remaining film shows: (16)

e. Cracking or alligatoring.

f. Sagging.

(17) Enter only anticorrosive formula numbers in this space. Do not omit.

(18) From report of previous docking.

(19) To be supplied by ship on form N.B.S.223a.

U.S.S. ZEBRA DOCKING DATE 1/25/42

CONDITION OF ANTICORROSIVE UNDERCOATS

Formulas applied at preceding docking 1st coat 84 (bare spots)
(17) 2nd coat 14 RC (touchup)
3rd coat 14 RC

("x" as appropriate to left of item)

g. Anticorrosive performance excellent.
X h. Rust streaks show through antifouling film.
X i. No black oxide, or very slight black oxide, beneath paint.
j. Considerable black oxide beneath paint and breaking through the film in scattered spots.
k. Anticorrosive films adhere poorly.
l. Rusty areas where antifouling film is missing.
m. Anticorrosive performance altogether unsatisfactory.

CONDITION OF BOOTTOPPING

Boottop Primer Formula 84 (18) applied at Preceding Docking.
Boottop Paint Formula 3 applied at Preceding Docking.
Boottop Area last Touched up by Ship with Formula 3 on 11/26/41 (19)
Boottop area is fouled for a vertical height of:
– inches throughout length.
10 inches at forward end.
8 inches at after end.
20 % of boottopping is missing due to

("x" as appropriate to left of item)

X n. Failure to adhere to undercoat.
o. Failure of undercoat to adhere to hull.
X p. Film too soft and washes off.
q. Film too brittle and flakes off.
X r. Abrasion.

Remarks on Pitting, Rivet Head Corrosion, Galvanizing Remaining, Non-Standard Paints:

Some rust and black oxide on bow where chains and paravane have chafed films off, and scattered spots on rest of bottom. 30% of rivet heads corroded. 80% of galvanizing remaining, (estimated from area uncovered by chipping). Performance of boottopping unsatisfactory. Considerable old pitting under paint, especially at waterline.

See separate letter report on condition of experimental A.F. paints applied on rudder at last docking.

U.S.S. ZEBRA DOCKING DATE 1/25/42

PREPARATION OF BOTTOM FOR PAINTING

	(1) METAL SCRAPERS	(2) HAND BRUSHED	(3) BLASTED	(4) FLAME DESCALED	(5) CHIPPED PNEU. HAMMER	(6) POWER BRUSHED
Underwater Indicate % of Area			20	5	75	100
Boottop			55	25	20	100

Indicate Location of Area: (3)- scattered areas where pitting was worst. (4) -to dry out surface after (3) & (5) - underwater: scattered spots between frames 20 & 60 port; boottop: stbd. aft of midship. (5) all surface except where old paint film was thin and in good condition or where flame descaled.

BOTTOM PAINTS APPLIED AT THIS DOCKING

	ANTICORROSIVE		ANTIFOULING	BOOTTOPPING PRIMER	BOOTTOPPING PAINT
FORMULA	84A	42A	142B	84A	3A
NO. COATS	1	1	1	1	2
QUANTITY	10 gal;	45 Gals.	4,100 Lbs. Gals.	9 Gals.	22 Gals.
METHOD (Spray or Brush)	Spray	Spray*	Hot Spray	Brush	Brush
ATMOSPHERIC CONDITIONS (Clear, Cloudy, Showers, Rain, Snow)	Clear	Cloudy	Cloudy Showers	Clear, Cloudy	Cloudy
TEMPERATURES (Dry Bulb) Max./Min.	53/59°		49/54	53/59	
DATE OF APPLICATION	1/27/42		1/28/42	1/27/42	1/27,28/42

*except part of port side forward of midship-brush application.

BOOTTOP LIMITS: Upper Edge at 10'6" Forward W.L. 9'6" Aft W.L.

Lower Edge at 8'2" Forward W.L. 9'3" Aft W.L.

REMARKS: *Note special conditions, experimental applications, etc.*

Cold plastic 165-Q-6; 16 gal.
Port side -frames 17-22, applied by spray.
Stbd.side -frames 52-62, applied by brush.
Undercoat 42A.

(20) See Table 2.

(21) Measure at top of shaft only unless shaft is not resting on bottom of bearing, in which case report sum of top and bottom clearances. Never measure side clearances. When bearings are rewooded, indicate clearances as follows:

As found	.217
As released	.050

If the ship is equipped with rubber bearings, note the fact. Mention if state of wear or damage indicates that renewal of these bearings should be made at the next docking. If the upper strips are, or have been, interchanged with the lower, the fact should be noted.

U.S.S. ZEBRA DOCKING DATE 1/25/42

SHAFT CLEARANCES

Shaft Diameter 9¼" Design Clearance .035 (20) Max. Allowed Clearance .175 (20)

Shaft Clearances when Docked (21)

SHAFT	STERN TUBE		INTERMEDIATE STRUT		MAIN STRUT	
	FWD.	AFT.	FWD.	AFT.	FWD.	AFT.
#1 - Stbd. Outbd.	.119	.092	.084	.105	.100	.106
#2 - Stbd. Inbd.	.105	.150	.120	.160	.061	.100
#3 - Port Inbd.	.100	.086	.095	.115	.049	.075
#4 - Port Outbd.	.170	.162	.100	.145	.078	.132

Remarks and Work Done *(If rewooded, indicate clearance when undocked)* Removed packing from stuffing boxes and took clearances. Removed #3 inboard stern tube bearing, rewooded same, and reinstalled with clearance of .100" Rewooding was done to correct alignment of stern tube shaft. Stuffing boxes were repacked with 6 turns of 1-1/8" felt packing. Packing surfaces are slightly grooved and #4 is worn approx. 1/32". Renewed #1 and #4 sealing rings. Other sealing rings and protector rings in good condition. Zincs are in good condition. Shafting, general condition and work done - Rough, pitted surface in way of #3 inboard stern tube (See Page 6.)

PROPELLERS

General Condition, Identification Data, Work Done, Disposition of Removed Propeller: Removed 1 and 2 propellers. Sent #1 to shop with old cone. Installed new #1, serial #3523, and cone. Nos. 2,3 and 4: straightened where bent, welded nicks, polished all over. Balanced #2 and reinstalled. Sounded all nuts, and refilled cones with tallow. Propeller data-see page 6.

Size of Propeller Nut Wrench 16" Location of Wrench on ship

(Form N.B.S. 426 is to be submitted only when propellers are shifted)

STRUTS

Condition and Work Done: Considerable pitting of all struts. Welded doublers on the following main struts: Port & Stbd. vertical, outboard & Inboard
Port & Stbd. horizontal, top side.
Port intermediate vertical - straightened and set to parallel line.

FAIRWATERS AND ROPE GUARDS

Condition and Work Done:
(Coupling) Fairwaters { Port -Removed 4 sets replaced 2 sets, and renewed 2 sets.
Stbd. -Removed 4 sets, replaced 3 sets, and renewed 1 set.

Rope guards: port and stbd. - renewed 2 sets each.

USS ZEBRA Docking Date 1/25/42

MARKINGS #1 PROPELLER

(a) Bueng Ser. 9999
(b) Bueng Plan 99-Z-0000
(c) Suitable for ZZ950-999 incl.
(d) Stbd. outboard
(e) Diam. 11', 4"
(f) Pitch 11', 11.989"
(g) Mfg. Mare Island. N.Y. 1938) (Mfg. XYZ Co.
(h) J.O. 999-Z-9999 Item 1) or (Contract 9999
(i) Wt. 12,534#) (Wt. 12,345#
(j) Propeller Key Secured by Press Fit only

HULL REPAIRS, WELDING, CAULKING OF RIVETS, SEAMS, ETC.

Renewed shell plating stbd. side (F-strake, frame 72 to 77) (E-strake 68-1/2 to 81-3/4) (D-strake, frame 68-1/2 to 81-3/4) (C-strake 68-1/2 to 81-1/2) (B-strake dblr. - frame 69 to 81-1/2) (A-strake dblr. 70 to 81) Welded dblr. portside. Frame 74 to 76 -A&B strakes. Welded T bar stiffeners on shell under longitudinals 1-1-1/2, 2-2-1/2, 3, 4, portside frame 74 to 76. Welded T stiffeners continuous starboard side under longitudinals 1-1-1/2, 2-2-1/2, 3, 4, frame 70 to 80. Welded T bars intercostal between T stiffeners under frame 71-1/2, 73, 74, 75, 77 and 79 centerline to longitudinal 4. Blanked port and stbd. condenser injector and discharge forward engine room. Renewed longitudinals 4-5-6-7-8-9 stbd. side from 68 to 82. Renewed frames 69-1/2, 73, 74, 75, 77, 79, 80-1/2 and made bulkheads 71-1/2, 68 and 82 tight by patching, welding and caulking. Caulked 200 rivets on shell. Cut off section of bilge keel from bulkheads 68 to 82 starboard.

SHAFT CLEARANCES - Continued from Page 5.

bearing smoothed by grinding, and polished. Shaft shows normal wear in way of other bearings, and moderate corrosion throughout exposed length. No other work done except chipping and coating with same paints as used on hull. If corrosion continues, sprayed metal coating is recommended.

(22) Note that per cent of total zincs is required.

U.S.S. ZEBRA DOCKING DATE 1/25/42

SEA VALVES, SCOOPS

Remarks and Work Done: Removed all strainers, replacing after work completed. Pitted areas of main injections: Welded 50 sq.in port; 60 sq.in. stbd. Removed obsolete valve port, fr.74, E strake and blanked off hole with flush patch. Installed new valve stbd.fr. 50, D strake. Overhauled and tested all other valves. Painted all sea chests.

ZINCS AND PROTECTOR RINGS

Per Cent of Total Number of Zincs Renewed: 75% 22

Condition and Work Done: Installed three additional zincs on each side of rudder Zincs not replaced are in fair-to-good condition. Protector rings are in good condition.

RUDDER

	As found:	Upper-	Lower-	As released:	Upper-	Lower-
Rudder Post Diameters:		18"	20"		--	--
Bearing Clearances:		.023	.064		--	--

Pitted Areas, Work Done: Removed rudder, refinished stock and pintle, renewed bushings and repacked stuffing box with 3-1/2 turns of 1-1/4" square flax packing. Welding, etc: Port:- Rewelded 22 plug welds, 5 ft. of seam, and welded on and pumped 40" x 78" doubler. Stbd: Rewelded 31 plug welds, 4 ft. of seam, and welded on and pumped 40" x 78" doubler. Tested rudder, found free from leaks and reinstalled.

HULL REPAIRS, WELDING, CAULKING OF RIVETS, SEAMS, ETC.

See page 6.

OTHER UNDERWATER WORK ON SOUND GEAR, ETC.

Installed echo sound apparatus bet. frames 24 and 26, port, as per plan #999-999. Mfgd. two covers (24-1/2" x 1" and 24-1/2" x 1/4") fitted and delivered to ship. Stbd. projector: removed pitted shaft, metal sprayed with monel, refinished and reinstalled-- J.O. 999-9-Z-9999/9999.

Copies to:

BuShips
Comd'g. Officers USS ZEBRA
Comzedron 99
Comzeddiv 0

John Doe

Richard Roe

Richard Roe
By direction

TABLE I.

TABLE OF DAYS BETWEEN TWO DATES

DAY MO.	JAN.	FEB.	MARCH	APRIL	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
1.	1	32	60	91	121	152	182	213	244	274	305	335
2.	2	33	61	92	122	153	183	214	245	275	306	336
3.	3	34	62	93	123	154	184	215	246	276	307	337
4.	4	35	63	94	124	155	185	216	247	277	308	338
5.	5	36	64	95	125	156	186	217	248	278	309	339
6.	6	37	65	96	126	157	187	218	249	279	310	340
7.	7	38	66	97	127	158	188	219	250	280	311	341
8.	8	39	67	98	128	159	189	220	251	281	312	342
9.	9	40	68	99	129	160	190	221	252	282	313	343
10.	10	41	69	100	130	161	191	222	253	283	314	344
11.	11	42	70	101	131	162	192	223	254	284	315	345
12.	12	43	71	102	132	163	193	224	255	285	316	346
13.	13	44	72	103	133	164	194	225	256	286	317	347
14.	14	45	73	104	134	165	195	226	257	287	318	348
15.	15	46	74	105	135	166	196	227	258	288	319	349
16.	16	47	75	106	136	167	197	228	259	289	320	350
17.	17	48	76	107	137	168	198	229	260	290	321	351
18	18	49	77	108	138	169	199	230	261	291	322	352
19.	19	50	78	109	139	170	200	231	262	292	323	353
20.	20	51	79	110	140	171	201	232	263	293	324	354
21.	21	52	80	111	141	172	202	233	264	294	325	355
22.	22	53	81	112	142	173	203	234	265	295	326	356
23.	23	54	82	113	143	174	204	235	266	296	327	357
24.	24	55	83	114	144	175	205	236	267	297	328	358
25.	25	56	84	115	145	176	206	237	268	298	329	359
26.	26	57	85	116	146	177	207	238	269	299	330	360
27.	27	58	86	117	147	178	208	239	270	300	331	361
28.	28	59	87	118	148	179	209	240	271	301	332	362
29.	29	. .	88	119	149	180	210	241	272	302	333	363
30.	30	. .	89	120	150	181	211	242	273	303	334	364
31.	31	. .	90	. . .	151	. . .	212	243	. . .	304	. . .	365

FOR LEAP YEAR, ONE DAY MUST BE ADDED TO EACH NUMBER OF DAYS AFTER FEBRUARY 28.

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TABLE 2.

LIGNUM VITAE AND RUBBER LINED BEARING CLEARANCES

A DIAMETER OF SHAFT SLEEVE (INCHES)	B MINIMUM TOTAL CLEARANCE OF NEWLY BORED BEARINGS (INCHES)	C TOTAL CLEARANCE AT WHICH BEARING SHOULD BE RENEWED (INCHES)	D=C/2 ECCENTRICITY OF BORE ABOVE TRUE CENTER AT AFTERMOST BEARING (INCHES)
1	.015	.070	.035
1½	.016	.081	.041
2	.017	.091	.046
2½	.018	.100	.050
3	.020	.107	.054
4	.022	.120	.060
5	.025	.131	.066
6	.027	.142	.071
7	.030	.153	.077
8	.032	.164	.082
9	.035	.175	.088
10	.037	.185	.093
11	.040	.196	.098
12	.042	.206	.103
13	.045	.216	.108
14	.047	.226	.113
15	.050	.235	.118
16	.052	.244	.122
17	.055	.253	.127
18	.057	.261	.131
19	.060	.269	.135
20	.062	.275	.138
21	.065	.281	.141
22	.067	.286	.143
23	.070	.290	.145
24	.072	.294	.147
25	.075	.297	.149
26	.077	.300	.150
27	.080	.303	.152
28	.082	.306	.153

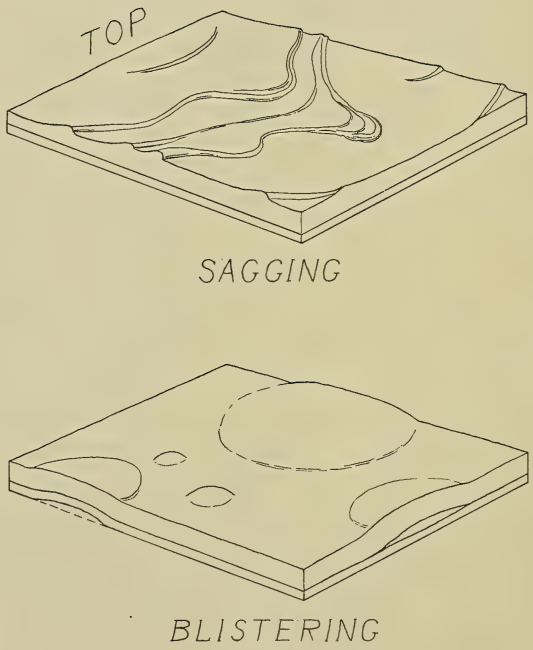
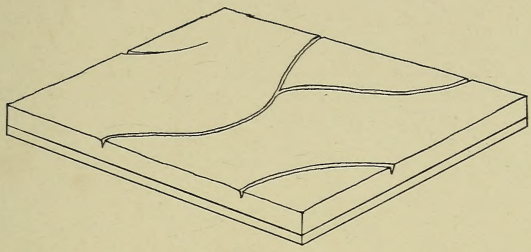
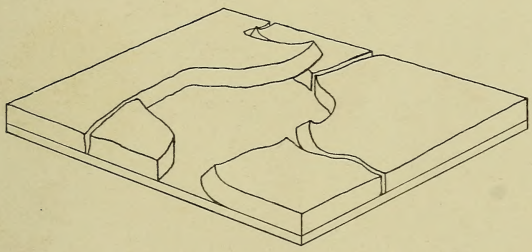


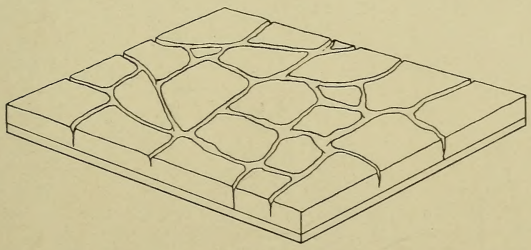
Fig. 19. Types of paint failure.



CHECKING (surface cracking)



CRACKING and PEELING



ALLIGATORING

Fig. 20. Types of paint failure.